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# Manual for Timber Reconnaissance

U.S. Department of Agriculture
Forest Service

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# MANUAL

FOR

Timber Reconnaissance
1914



FOR USE OF FOREST OFFICERS ONLY

District One, Missoula, Mont.

F. A. SILCOX, District Forester



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## MANUAL FOR TIMBER RECONNAISSANCE

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#### INTRODUCTION.

The following instructions give in detail the methods of reconnaissance which have been authorized by the Forester and by the District Office for District 1. They are based on the conduct of intensive projects by standard crews. They should also be applied, however, to extensive projects and to cases where circumstances make it necessary that very small parties or even individuals examine bodies of timber in preparation for a sale. In intensive projects of standard size, deviations from these instructions should be made only with the consent of the District Office.

#### EXTENSIVE RECONNAISSANCE.

For the intelligent selection of areas which will make attractive logging chances and which later may need to be covered by intensive reconnaissance, and to make possible a fair division of reconnaissance funds between Forests to secure data for use in a rough calculation of the annual growth and also of value for other purposes in the administration of the forest, a systematic cataloging of timber resources is of vital importance. Supervisors should, therefore, take advantage of every opportunity to complete extensive reconnaissance over their Forests. This work can be done in many cases for each ranger district by the Ranger in charge, but should be directed by some one man on each Forest who is responsible for assembling and checking all the data received.

The data which should be obtained in connection with extensive reconnaissance is as follows:

- 1. A type map usually on the scale of one mile to the inch, the typing being on a rather broad basis.
  - 2. An age class map similar to the type map.
  - 3. An approximate estimate by species for each watershed.

Considerable variation in methods will be necessary due to differing local conditions. In general much cruder and more rapid methods than those described in these instructions will be necessary. Under normal conditions one man working alone should cover about a township a veek. The details of these instructions for intensive reconnaissance will obviously be merely suggestive as to the methods to be used.

#### INTENSIVE RECONNAISSANCE.

Object and Scope—The object of all intensive reconnaissance is to secure data for (1) timber sales and (2) working plans. While the former object is immediate and the latter may be postponed, the reconnaissance data collected should be sufficiently inclusive so that no subsequent field work is necessary except to secure estimates of logging cost for stumpage appraisals and to determine the exact sale boundaries after applications have been received.

The data required for these two purposes are, first, a map showing topography, culture,, Forest types, age classes and other information; second, estimates by convenient subdivision in such form as to be of use both for sales and for regulating cut; and third, descriptive notes covering the silvicultural conditions and the factors affecting logging.

Selection of Areas to Be Covered—The following principles will govern the order of selection of areas to be covered:

- 1. Areas for which formal or informal sale applications have been received and where sales are desirable.
- 2. Areas within which desirable sales can undoubtedly be made in the near future if reconnaissance data are available.
- 3. Divisions in which there is danger of overcutting either in large or small sales, (a) in excess of the amounts which should be reserved for local needs and in guaranteeing a reasonable operating life for improvements constructed in connection with sales, and (b) in excess of sustained yield.

For the present it will be necessary to limit reconnaissance strictly to areas of the first class.

#### PRELIMINARY FIELD EXAMINATION.

To insure that a proposed project falls into this first class, a preliminary field examination should be made. The mere fact that an application has been received does not always mean that a sale is possible or advisable. This preliminary examination should be made well in advance of the beginning of actual field work and, if possible, by the man who will have charge of the project.

#### POINTS TO BE COVERED.

- 1. The desirability and probability of an immediate sale.
- 2. That portion of the area which should be covered by reconnaissance.
  - 3. The maps and other data available for present use.
  - 4. The plan of topographic control.
  - 5. The per cent of the area which should be estimated.
  - 6. The size and organization of the party.
- 7. The equipment needed, transportation facilities, trail construction necessary, possible camp sites, etc.
  - 8. A tentative division of the area into logging units.
  - 9. Deviations, if any, considered advisable from these instructions.

#### EXTENSIVE RECONNAISSANCE MAP.

If not already in existence, an extensive reconnaissance map should be prepared in connection with the preliminary field examination. On this, much of the above mentioned information can be entered.

#### PRELIMINARY PLAN.

As the result of this examination the preliminary plan will be prepared in co-operation with the Supervisor by the man examining the

area, for the approval of the District Forester, and should be a solution of the above points under examination. Unless modified by the District Forester in writing, this plan of work will remain in effect until the project is completed. Subsequent projects on the same division or Forest should be carried on as far as possible along similar lines.

#### DISTRICT OFFICE SUPERVISION.

The preliminary plan will be checked, where considered advisable, by one or more representatives from the District office, including, if possible, the logging engineer, who will ultimately appraise the timber. As soon as practicable after the actual field work has commenced, a representative of the District office will visit the crew to assist in lining up the work and in standardization of methods.

#### METHOD OF WORK.

The reconnaissance field work is to be done by what is known as the strip system. The principle of this is that parallel strips located at definite intervals are estimated carefully and taken as samples representing the whole area. These strips are usually one chain in width. The distance between strips depends on the character of the timber and varies from one-eighth to one-half mile. While the strips of each series are run parallel to each other, the general direction chosen is that which cuts the drainages most nearly at right angles (as better averages are thus obtained) and at the same time gives the shortest distances between control lines. In surveyed country, however, the cardinal direction most nearly satisfying this condition is chosen. The estimating of the strips is done by crews of two men, consisting of an estimator and a compassman. The data obtained are a tally of each tree standing on the strip by diameter, in inches breast high, and by height, in 16-foot logs. Computation of this data is by means of volume tables which show the average contents in board measure, by species, of trees of each given diameter and height. Since these volume tables are based on sound timber, a deduction must be made for defect if any is present. estimate for a 40 or other unit is obtained by multiplying the volume of the timber on the strips run within that unit by a "Correction Factor," which represents in the judgment of the estimator the ratio between the timber on the unit and on the strip.

#### ORGANIZATION.

The standard crew is as follows:

Chief of party.
Draftsman.
Four estimators.
Four compassmen.
Cook, packers, or teamsters, etc., as needed.

The Chief of Party should be a man thoroughly trained in reconnaissance work and of sufficient executive ability to secure accurate and effective work from his erew.

The draftsman should be not only an efficient draftsman, but also sufficiently acquainted with topographic sketching to be able to check and instruct the field men along this line and to adjust intelligently conflicting field sheets. Experience with the transit and other instruments is also a desirable qualification.

The estimators and compassmen should, if possible, have had previous experience or training in reconnaissance. At least 50 per cent should have had previous training in Forest Service reconnaissance crews. A Forest school education is an asset. Previous experience in timber cruising alone, while extremely valuable in the right type of man, is not so great a qualification as a knowledge of reconnaissance methods and a ready adaptability to woods work. This is because in reconnaissance more than a mere cruise of the timber is being secured.

#### RESPONSIBILITY FOR THE PROJECT.

The Chief of Party is responsible directly to the Forest Supervisor, who, in turn, is, of course, responsible to the District office. While it is often found convenient that the crews be organized by the District office and transferred from Forest to Forest in accordance with the needs of the work, yet each crew, while on a given Forest, should be considered as much a part of that Forest's organization as a crew engaged in any other line of work.

#### DUTIES OF THE CREW MEMBERS.

Following is a brief summary of the duties of each member of the above listed organization. The details of their work are explained on later pages.

#### CHIEF OF PARTY.

- 1. Prepare the preliminary plan.
- 2. Have direct charge of the personnel of the party; maintain its efficiency; have full authority in consultation with the Supervisor in releasing unsatisfactory men, in hiring and in fixing the rate of pay of temporary employees.
- 3. Assume direct responsibility to the Supervisor for all work done on the project. This responsibility can be properly assumed only when the Supervisor delegates ample authority to the Chief of Party.
- 4. Select and train one of the members of the crew as an Assistant Chief of Party to act as Chief of Party in his absence.
- 5. Delegate authority when necessary to permit himself ample time for acquiring familiarity with the country to be covered, for checking the character of the field work done, etc.
- 6. Provide for systematic recording and filing of the data collected, so that they can be turned over to a successor, if necessary, for completion.
- 7. Be responsible for the compilation and final completion of the field data and of the summaries.
- 8. Submit a brief monthly progress report in duplicate to the Supervisor, the extra copy to be forwarded to the District office.

9. Keep records of the cost of the work and submit cost reports as hereinafter described.

#### ESTIMATOR.

- 1. Estimate the timber (Form 494).
- 2. Note the silvical data (Form 494).
- 3. Assist the compassman in determining the boundaries of types, age classes and of the merchantable timber, and the density of the stand, and determine the age class by use of the axe where necessary,
- 4. Assist the compassman by consultation in noting the logging data.
  - 5. Compute the estimate sheets.

#### COMPASSMAN.

- 1. Direct the course of the line by compass.
- 2. Obtain distances by pacing.
- 3. Obtain elevations by barometer or Abney level.
- 4. Notify the estimator at the end of each 40 or other unit determined and leave a mark to designate this point, which may be easily picked up by anyone wishing to check the work.
- 5. Check his line for distance and direction on section corners or established control points.
- 6. Map in the field the area traversed (Form 493) including topography, culture, types, boundary of the merchantable timber, density of timber or normality.\*
  - 7. Note the logging data (Form 493).
  - 8. Assist the estimator by consultation on the silvical data.

#### DRAFTSMAN.

- 1. Check, and correct, if necessary, the compassman's field maps.
- 2. Compile these maps into a base map.
- 3. Be custodian of the camp property and records.

#### CONTROL METHODS.

The principles governing the selection of a system of control and the field methods involved in running the control lines are covered in the instructions for topographic survey.

#### THE ESTIMATE.

The per cent of the area to be covered by the strips depends upon the character of the timber. In timber of small size, where the stand is essentially uniform, where comparatively little underbrush is present, or where the timber is of relatively small value, a 5 per cent estimate is sufficient. Where the timber is large, uneven in distribution, or considerable value, and where underbrush is dense, a 10 per cent estimate is necessary. In extensive areas of grass land, brush, etc., a 2½ per cent estimate is sufficient. A 10 per cent estimate requires two strips

\*See Appendix under "Normality Description."

through each 40 or its equivalent; a 5 per cent estimate, one; while for the  $2\frac{1}{2}$  per cent two strips through each section or its equivalent is required. In general, 5 per cent is considered standard for the lodgepole region, and for the smaller and more uniform timber of the white pine region, while 10 per cent should be used in most cases in the more valuable white pine stands. The more intensive estimate is also necessary in the case of isolated government forties, surrounded by alienations. The unit of estimate should be the 40 on surveyed ground, while on unsurveyed, the unit should be adopted by the Chief of Party usually on the basis of logging units. On surveyed ground, a single sheet (Form 494) should be used for each 40 except where the 40 lies within two distinct logging units, when separate sheets should be used for each. Similar principles should govern the use of sheets on unsurveyed projects, but timber on not to exceed two acres should be tallied on a single sheet.

#### ESTIMATE SHEET FORM.

Form 494 should be used for securing the estimate. In the case of surveyed land the township, range, section, forty, and meridian should be entered at the head of each sheet and the 40, with the direction in which the strip or strips are run, also noted by means of an arrow in the block of 16 squares. In unsurveyed areas the location of the sheet should be identified by township and range, if possible, and by such numbers and letters as will clearly correlate the estimate sheets with the draftsman's base map. The initials of the compassman and estimator, and the date should also be entered in the proper space. A vertical column should be used for each species. Use of a miscellaneous column should be avoided. The horizontal columns should be numbered by oneinch classes in the lodgepole region and by two-inch classes in the white pine region. The minimum diameter to be estimated is 8 inches. The tallying of the trees is by numbers expressing their height in merchantable logs, i. e., a 4 entered in the vertical column headed "White Pine," and in the horizontal column headed headed "20" represents the white pine tree 4 logs in height and 20 inches in diameter. In case the number of trees to be tallied is so great that the space for a given size will obviously be insufficient, a condensed form of tally is made possible by the use of the dot system, following the number or numbers expressing the height. In tallying, the d. b. h. (diameter breasthigh) is obtained by ocular estimate, checking the eye frequently by the Biltmore stick (or diameter tape or calipers, if Biltmore sticks are not available.) The height of the trees is obtained by ocular estimate, checking the eye by pacing windfalls wherever available and by the use of the hypsometer, The width of the strip should be frequently checked by pacing out to doubtful trees. In types where a large number of unmerchantable trees are present (as in the case of white pine with its defective cedar, hemlock and white fir) a column should be reserved for a tally of these unmerchantable trees. A column should be also used for any special products present. In a cedar pole column, for example, the d. b. h. figures should be disregarded and the column should be divided into four parts headed respectively "25 feet," "30 and 35 feet," "40 and 45 feet," and "50 and 55 feet." A column for cedar logs is usually necessary to take care of the butts of trees from which a pole can be secured from the tops. The logs should be tallied by top diameter opposite the proper figure of the d. b. h. column. A column for ties may be used where considered advisable, but the use of the regular form of tally supplemented by tie volume tables when separate tie estimates are advisable, is preferable.

#### CULL.

Since the volume tables are prepared on the basis of sound trees, it is necessary to estimate the percentage of the cull for each species found on the strip. Defect of all sorts should be entirely handled by this method rather than by reducing the diameter or the height of individual trees tallied. The cull figures estimated for each species should be entered on Form 494. Trees which are absolutely unmerchantable should be tallied in an unmerchantable tree column and the cull factors therefore need not take these into consideration. In the case of very defective species, as hemlock and white fir, where practicable, a separate tally should be made of apparently sound and unsound merchantable trees.

#### CORRECTION FACTOR.

The correction factor is the figure by which the estimate for the strip or strips within a given 40 or other unit must be multiplied to give the estimate for the whole unit. It is usually obtained by dividing the acreage of the timbered area within the unit by the acreage of the timbered area upon the strip or strips. If the unit is solidly timbered, the correction factor in the case of a 10 per cent estimate is ordinarily 10 and of the 5 per cent estimate, 20. A further discussion of less obvious cases is to be found in the appendix.

#### COMPUTATIONS.

Each estimator may be held responsible for the computation of his estimate sheets, or such other arrangement made for handling this part of the work as seems best to the Chief of Party. The volume of each size of tree tallied is obtained from the proper volume table and multiplied by the number of trees of that size as shown by the tally sheet. This step in the operation may be eliminated by the use of the multiple volume tables given in the appendix. An addition of each species column separately gives the "Volume on strip" of that species. This figure should be entered in the proper space at the bottom of Form 494. These figures are then reduced by multiplying by one minus the cull per cent, the result being the "Volume on strip net." Multiplication by the correction factor then gives the "Volume on 40."

The column for cedar poles is merely totaled by height classes and the column for cedar logs is handled similarly to the regular species estimates, using the Scribner Log Rule in place of a volume table. The number of logs and the number of trees by species is obtained by a simple count and entered in the appropriate spaces: ("Logs No." and "Trees No."); the "Logs per tree" results from dividing the number of logs by number of trees, and the "logs per M" from dividing the number of logs by the "Vol. on strip net." The "Volume to cut" need not be calculated by the reconnaissance men, but may be filled in, if desired, by the Supervisor. (Omit if this heading is eliminated from the form).

The heading on the back of this Form, "Location of Timber," should be used to indicate any conditions covered by this heading not satisfactorily shown by the map. Notes such as "all cedar is within 2 rods of creek" or "80% of white pine is on north slope" are of immense value, and should be freely entered.

#### THE SILVICAL DATA.

The purpose of the silvical data notes is a description of the timber and of the site from the standpoint of silviculture. Its use is primarily to aid in determining the advisability of a sale and the silvicultural method applicable.

The silvical data which is to be noted is indicated by the headings on the back of Form 494. Observations should be made constantly while passing through the 40, and entries should be made before leaving it. If two strips are taken in a given 40, the entry should be made at the end of the first strip and these entries should be checked at the end of the second, any differences found being noted. The use of initials E. and W. (east and west) and N. and S. may be used to indicate varying conditions on the two strips.

The conditions of the stand is described by the use of one of the three words, thrifty, mature or decadent. Mature timber is that which has passed the point of rapid growth, but has not yet commenced to retrogade. In general, the age of mature timber is from 120 to 160 years. The words thrifty and decadent are sufficiently limited by this definition of the word mature.

Notes on damage include that by fire, by insects and by other agencies. The points to be noted are sufficiently indicated on the Form.

The average clear length of the timber should be noted for each species in 16' logs and half logs. By "clear length" is meant that portion of the bole of the tree which is practically free from branches, live or dead, and is not included in the crown.

Under "Reproduction" on the back of Form 494 is included only that reproduction which is of importance from the standpoint of future timber crops. Young hemlock, white fir, for example, standing beneath mature white pine, will undoubtedly be largely destroyed in logging and is not here to be considered. Such worthless reproduction is treated merely as "brush" under logging factors. The notes to be taken on young stands, and on the young individuals in these selection stands are fully indicated by the headings on the Form.

Soil is described by composition, degree of moisture and depth. The word loam should be used to indicate any mixture of sand and clay, silt and clay, or either sand, clay or silt with humus which results in the crumbly consistency commonly indicated by this term. By silt is meant siliceous material so pulverized as to have no gritty feeling; that is, it is simply an exceedingly fine sand. It lacks the characteristic odor of clay and will not remain in suspension in still water more than a few hours. Silt is not necessarily confined to alluvial deposits, although there is its most common occurrence. Sand, clay and gravel need no definition. By fresh soil is meant soil containing sufficient moisture to be damp to the touch, but not sufficient so that drops can be expelled by pressure of the hand. Moist and dry are sufficiently limited by this definition of the word fresh.

By soil of moderate depth is meant that between six inches and two feet, with the words shallow and deep limited accordingly.

Under the heading "Rock" should be entered the character of the underlying formation if it can be determined, as granite, shale, limestone, etc.

Under undergrowth should be entered (1) the species in their order of abundance; (2), the density of the patches of brush, etc., as open, medium or close, and (3), the percentage of area covered by the patches.

Type, age class and density or normality, although indicated only on the map, are strictly silvical characteristics, and it should be the estimator's duty to keep these factors in mind and to assist the compassman in making the proper entries on his map.

#### THE FIELD MAP.

The field map should be made on Form 493, using the scale 4 inches to the mile to which this Form is adapted.

On this map should be entered topography and culture in accordance with the instructions for topographic work. Types and age classes and the density or the normality of the stand should also be indicated. The type and age class is of importance from the standpoint of marking which in turn directly influences the stumpage value, and also from the standpoint of yield studies. Density figures are chiefly of descriptive The boundaries of these types, etc., should be indicated by dotted lines and within each boundary symbols expressing the type, age, class and density or normality should be entered. The minimum area to be distinguished as a separate type or age class is 5 acres. areas, however, which are important by reason of special features of topography or culture, such as small bodies of water, swamps, and barren or grass patches occurring in great contrast to the surrounding area, should be shown on the map. In the appendix can be found a definition of the types and the symbols used to indicate each. boundary of the merchantable timber should also be determined as closely as possible by the crew, and checked by the Chief of Party. When at all practicable this work will be checked by the appraiser during an early part of the field work. This may be indicated on the map

by the following symbol: —. —. Unless the line is very distinct and

certain, the estimate should always be carried some little distance into the unmerchantable area. It is usually sufficient to merely complete the "40." For definitions of types and age classes see Appendix (Pg. ). In estimating crown density in a given case, the part of the total canopy space normally occupied by a full stand which is occupied by trees of all species whether merchantable or unmerchantable, of the same general age class, is designated by a figure—1 to 10; 10 representing a full stand. In the case of a broken stand with the vacant spaces stocked with seedlings, the density figure will apply to the older stand and not to the reproduction.

#### LOGGING DATA.

The purpose of the notes described under the term "Logging Data" is a description of the surface conditions of each unit from the stand-

point of logging. These notes should be secured even if there is no merchantable timber at the present time upon the unit, since it is probable either that merchantable timber upon other areas may have to be removed across this unit or that at some future date logging operations will have to be planned on the basis of the present notes. This data is noted on the back of Form 494. For the purpose of description, the area is divided into three heads: general surface, major, and minor transportation routes. The general surface is what affects the cost of logging in place, including felling, swamping, brush disposal, skidding, etc. The minor transportation factors influence such operations as chuting. The major transportation factors bear upon the feasibility of road construction, flume building, etc. Notes are also taken on streams and stream flow from the standpoint of fluming and driving.

Under each main division the various factors to be considered are entered on the sheet. Beneath each factor are two or more description terms. Beneath each of these terms is a block of 16 small rectangles which correspond by location with the 16 forties of the Section map on the front of the sheet. The notes are taken by entering a check mark in the proper rectangle beneath the proper term. If it is desirable to distinguish between the east and west or north and south part of a 40, the initials E. and W., etc., can be appropriately entered.

Under such headings as "Rock" where the space available does not permit an adequate description, numerals can be entered which refer to references made on the blank lines on the bottom of the sheet.

The stream flow in cubic feet per second need be taken only at the lowest point at which a main stream or any of its forks is crossed by any strip.

#### TRAINING OF CREW.

It is essential that each crew be thoroughly trained in every detail of the work of a given project before the data secured shall be considered reliable. Such training is necessary in spite of previous experience which the crew members may have had and alone can insure the desired degree of accuracy and uniformity in the data secured. In such training it is necessary for the Chief of Party to spend more or less time in the field with the crew as a whole and with each member of the crew separately in the practice of each detail of the work. It must be assured, that is, not only that the estimate is accurate, but that each member of the crew means the same thing when he states that the underbrush is moderate in density, etc. As complete a standardization as is possible within each crew of the terms used is of far more importance than standardization between crews working on different forests. It is, however, desirable that as nearly as possible the same standards be used for all work done on a given forest, even if covering a period of years. This can only be accomplished by the Forest Supervisor keeping in close touch with the work of each crew which may be assigned to him.

#### CHECKING.

Two forms of checks are possible; a check of the method used and a check of the men themselves. The former can best be obtained by having men who through experience are considered absolutely reliable and accurate judges of timber cruise 40's already covered by reconnaissance.

Since, however, the methods described in these instructions have been given thorough trial, this form of check can usually be omitted. The second form is much more important, as it serves an additional purpose in instructing the men and raising their standards of accuracy. Details of a method which has been found of considerable value are given in the Appendix. The results of all checks made should be included in the Monthly Progress Report.

#### SUMMARIES.

The field data gathered by a reconnaissance crew is so voluminous that it is of little value unless carefully summarized. The responsibility for this summation rests on the Chief of Party. Separate summaries of the four classes of data above described should be made, preferably by logging units. The form which each should take follows:

- 1. Estimate Data—The summary of the estimates can be most conveniently put in the form of a tabulation. For this tabulation the estimates for each logging unit will be transferred from the 40 sheets involved to a summary sheet for this unit. For each probable timber sale chance the summary sheets of the logging units involved will in turn be summarized for that chance by type and age class as explained in the Appendix. On certain areas where the proportion of very small or very large timber (such as 40 per cent of the white pine on a given chance being over 30 inches d. b. h.) can be anticipated as a factor in making the appraisal and sale, these sizes should be separately summarized from the start, and each 40 sheet computed with this in mind. Not only the total stand but also the logs per tree and per M. and the cull per cent should be shown. The average acre should also be given by logging units. Notes on the young growth, while strictly a portion of the estimate, can best be handled by including them under silvical data. For sample summary see Appendix page.
- 2. Silvical Data—The summary of the notes on silvical data should take the form of a concise, but precise description of the logging unit from the standpoint of each heading on Form 494. In addition the silvical data from the map should be calculated and stated, including such information as the area within each type and age class, the density figures, etc. For sample summary see Appendix page.
- 3. Map Data—The base map is the only summary of the map data which is necessary. Full instructions for compiling this are given in the instructions for topographic mapping. This base map should be kept strictly up to date. Adjustments of type lines, etc., where the field sheets of two different compassmen disagree should be made immediately, while both men still have a definite recollection of the area.
- 4. Logging Data—The summary of the notes on logging data should take the form of a brief description of each logging unit from the standpoint of the headings on the back of the Form 493. The description can often be best made by means of rough percentages. For sample form of summary, see Appendix page.

In addition to the above summaries for the logging units, additional summaries should be made for each major drainage covered by a specific project. Further summaries by divisions or for the forest as a whole are not to be made by the reconnaissance parties, but can be compiled, if thought desirable, by the Supervisor.

#### EMPIRICAL YIELD TABLE DATA.

Data on yield is essential in the prediction of future growth, so that in the preparation of the working plan for the management of the Forest it is quite as essential that yield data be collected as that a reconnaissance of the present resources of the Forest be made.

The summarization of estimate data by type and age class as outlined in these instructions will make all such data collected available for empirical yield studies. It is therefore very important that the several age classes be accurately mapped and continual use of the ax for making age determinations will be necessary.

#### APPRAISAL OF TIMBER.

The appraisal of the timber examined is not a part of the duties of the reconnaissance crew. Figures on the cost of logging can best be collected by competent logging engineers after the reconnaissance data is summarized.

#### MONTHLY PROGRESS REPORT.

At the end of each month the Chief of Party should submit a progress report in duplicate to the Supervisor; the original being forwarded by the latter to the District office. This report should be a concise statement of the progress made and should mention any unusual features of the work or unexpected problems met. It should also contain the results of the check estimates made during the month.

#### MISCELLANEOUS.

All equipment should be obtained through the Supervisor's office in the usual manner. The District office endeavors to keep on hand, however, a small supply of barometers, compasses and similar instruments so that in case of emergency time may be saved by wiring to Missoula for additional equipment needed. In the Appendix will be found lists of the necessary equipment for the standard crew.

In certain instances modifications from the form of reconnaissance herein described may be desirable. These should be adopted by members of the party only with the consent of the Chief who should restrict them to unusual instances. Methods which are authorized in such emergencies are described in the Appendix.

Cost-keeping records should be carefully kept. The forms which should be used are given in the Appendix. Copies may be obtained from the District office. The nature of the cost records and the detail in which the figures are desired are definitely indicated by these forms.

The original field data should in all cases be considered as a permanent record and should be filed in the Supervisor's office.

#### **APPENDIX**

#### CRUISER STICK.

The Forest Service Cruiser Stick has four sides: (1) Biltmore stick, (2) Merritt hypsometer, (3) Scribner Decimal C scale for 16-foot logs, (4) inch scale. The last two are for convenience in finding the approximate contents of fallen trees. Detailed instructions for the construction and use of the Biltmore stick and Merritt hypsometer follow:

#### BILTMORE STICK.

To use the Biltmore stick, the observer holds it in his right hand horizontally against the tree  $4\frac{1}{2}$  feet (breasthigh) from the ground, and 25 inches from his eye, which should be on a level with the stick. If necessary the head should be lowered till the eye is at the proper height. The distance from the tree can be measured by placing the zero end of the stick against the tree and holding the eye at the 25-inch point marked on the back of the stick.

#### FORM AND CONSTRUCTION.

In the absence of the standard Cruiser stick a Biltmore stick may easily be made. It should be similar to a scale stick in both material and size, except that its length need be only 36 inches or less, if intended for trees 60 inches or less in diameter. Three methods of graduation are possible.

- 1. One edge may be beveled and the graduations entered on this edge.
- 2. The edges may be left square and the graduations entered on the broad faces.
- 3. The edges may be left square and the graduations entered on the broad faces as lines radiating from a series of points representing the successive positions of the eye for trees of various diameters. Center lines corresponding to each radial line should also be entered crossing the stick at right angles. A stick of this pattern should be held with its edge rather than its flat surface against the tree. The radiating lines are useful to a certain extent in keeping the eye at the proper distance.

In either case it is helpful to enter the arm length on the narrow edge.

#### FORMULAE.

(A) 
$$S = V = \frac{d^2 a}{a + d}$$
 (B)  $S = \frac{d(a - t)}{aV(a + d)}$ 

Where S\_Graduation distance on stick.

d—Diameter of tree.

a\_Arm length or distance stick is to be held from eye.

t\_Thickness of stick.

Formula A is to be used for patterns of sticks which are so arranged that the graduations are in a line strictly tangent to the tree. This is true in the construction described in 1 and 3 above. In construction 2 the visible graduations are separated from the tree by the thickness of the stick and Formula B should be used.

TABLE.

Diameter breast	r.		Dista	nce (a)	from	eye to	tree—	Inches.		
high (d)	2	13	2	4	2	5	2	6	27	ī
Inches		Actual	distan	ces (s)	in inc	hes to	be man	rked on	stick.	
	A.	В.	Α.	В.	$\Lambda$ .	В.	Α.	В.	Α.	В.
6	5.34	5.29	5.37	5.31	5.39	5.34	5.41	5.36	5.43	5.38
8	6.89	6.82	6.93	6.85	6.96	6.90	7.00	6.93	7.03	6.96
10	8.35	8.26	8.40	8.31	8.45	8.36	8.50	8.41	8.54	8.46
12	9.73	9.67	9.80	9.69	9.86	9.76	9.93	9.83	9.99	9.89
14	11.03	10.02	11.13	11.01	11.21	11.09	11.29	11.17	11.37	11.25
16	12.29	12.15	12.40	12.26	12.50	12.36	12.59	12.46	12.68	12.56
18	13.49	13.34	13.61	13.47	13.73	13.59	13.84	13.70	13.95	13.81
20	14.63	14.46	14.77	14.61	14.91	14.75	15.04	14.89	15.16	15.02
22	15.72	15.55	15.89	15.72	16.05	15.89	16.19	16.05	16.34	16.19
24	16.79	16.60	16.97	16.79	17.14	16.95	17.30	17.11	17.46	17.30
26	17.81	17.62	18.01	17.82	18.20	17.99	18.38	18.20	18.55	18.38
28	18.80	18.59	19.02	18.82	19.23	19.04	19.43	19.24	19.62	19.44
30	19.76	19.55	20.00	19.79	20.22	20.02	20.44	20.24	20.65	20.46
32	20.69	20.47	20.95	20.72	21.19	20.97	21.42	21.21	21.65	21.45
34	21.59	21.36	21.86	21.64	22.13	21.91	22.38	22.16	22.63	22.42
36	22.47	22.23	22.76	22.52	23.04	22.81	23.30	23.08	23.56	23.35
38	23.32	23.07	23.64	23.38	23.94	23.69	24.23	23.99	24.49	24.27
40	24.17	23.91	24.49	24.24	24.80	24.56	25.10	24.86	25.40	25.16
42	24.98	24.71	25.32	25.05	25.65	25.38	25.96	25.71	26.27	26.03
44	25.78	25.50	26.13	25.87	26.48	26.23	26.81	26.55	27.13	26.89
46	26.55	26.26	26.93	26.65	27.29	27.01	27.64	27.36	27.89	27.72
48	27.31	27.01	27.71	27.41	28.09	27.80	28.46	28.17	28.80	28.54
50	28.07	27.76	28.48	28.18	28.86	28.57	29.24	28.96	29.61	29.34
52	28.79	28.48	29.22	28.91	29.63	29.32	30.02	29.72	30.40	30.11
54	29.51	29.18	29.95	29.63	30.38	30.06	30.79	30.48	31.18	30.89
56	30.22	29.88	31.11	30.35	31.53	30.79	31.94	31.22	32.33	31.64
58	30.90	30.56	31.38	31.04	31.83	31.49	32.27	31.94	32.69	32.38
60	31.58	31.23	32.07	31.73	32.54	32.20	33.00	32.67	33.43	33.12

Values headed "A" and "B" are calculated from the formulae correspondingly lettered. In B "t" is assumed as ¼ inch.

#### CORRECTIONS IN USE.

For absolute accuracy the following conditions must be fulfilled. The tree must be circular in cross section; the stick must be held against the tree at a point 4½ feet from the ground; the stick must be horizontal; the line of sight from the eye to the stick at the point of contact with the tree must be perpendicular to the axis of the tree, i. e., horizontal if the tree does not lean; the stick must be perpendicular to this line of sight; the eye must be at the proper distance from the tree. If any of these conditions are not strictly fulfilled an error will result. The various sources of error are not, however, of equal importance. The following table will show how serious a variation from the above named conditions will produce an error of 1% in diameter for 10 inch, 30 inch and 60 inch trees; also the direction of the error:

-				
		Resulting	g in erro Diamete	or of 1% in er
Sign '	Cause	D. B	. H. of	Trees.
-		19"	30''	60"
	Eye above or below stick by	9.2"	7.3"	7.1"
+	Stick not horizontal—one end higher than other by	4.6"	4.2"	4.1"
	Stick not perpendicular to line of sight—one end nearer the eye			
	than the other byEye too near to or too far from tree	4.9"	4.9**	5.1"
	by	1.4"	.45''	.65"

The error resulting from taking the measurement at a point which is too high or too low varies of course greatly with the species and form of the tree. In general, however, it will be negative owing to the inconvenience of stooping to the proper height. The above table shows conclusively that the only dangerous source of error is in the distance of the eye from the tree. Fortunately, this is apt to be more or less compensating. Furthermore, the errors constant in sign may offset each other to a certain degree.

It should be further noted, however, that particular care should be taken in the case of irregular trees. Measurements of a smaller diameter will be reduced and of a larger diameter will be increased by use of the Biltmore stick. This exaggeration of the errors of the caliper in this case makes it particularly important that either two measurements, or a measurement of an average diameter be taken where an accurate measurement of a single tree is desired.

#### MERRITT HYPSOMETER.

The Merritt Hypsometer is designed for measuring height in 16.3-foot logs at two different distances from the tree, namely, 1 chain and  $1\frac{1}{2}$  chains. It is used as follows:

- (1.) Pace a distance of one chain, or a chain and a half, measured horizontally, from the tree.
- (2.) Hold the stick vertically, squarely in front of the eye, and as nearly plumb as possible. After some practice it can be plumbed with a fair degree of accuracy by holding at the lower end and balancing: if the tree is downhill it can sometimes be held near the upper end and plumbed by its own weight. The hypsometer side should be at right angles to the observer's line of sight.
- (3.) Raise or lower the stick until its lower end, or any convenient mark for the proper distance, intersects stump height on the tree.
- (4.) Holding it in this position, read on the proper scale the distance intersected by the top of the last log. If the observer is at one chain from the tree the height will be shown by the left hand scale, or large figures, if at one and a half chains, by the right hand scale, or small figures.

Height may be measured with this hypsometer on the level or on any slope, either above or below the tree, provided the distance from the observer to the tree is the horizontal distance. For very tall trees, double the distance will give double the number of logs.

Any straight stick may readily be made into a Merritt hypsometer. The following table gives measurements to be used for the different reach intervals.

For use	one chain from tree.	For use 1½ chains from tree
Distance from eye to stick.	Interval on stick for measuring one log (16.3') on tree.	Interval on stick for meas- uring one log (16.3') on tree.
23'' 24'' 25'' 26''	5.68" 5.93" 6.18" 6.42"	3.78" 3.95" 4.11' 4.27"
27"	6.67"	4.44"

#### CHECKING.

The importance of an adequate checking system can hardly be overemphasized, particularly in the case of less experienced men. The method often employed formerly, of handling this question by having some lumberman cruise occasional forties after the reconnaissance, has seldom proven entirely satisfactory, since even at best, this system merely measures the error without determining its cause.

#### SYSTEM FOR ANALYSIS.

The following system has been tried with considerable success, and has the advantage of giving an analysis of each man's errors as well as determining their amount. One of the most experienced estimators is chosen as a check estimator. This man, with a compassman, re-runs forties already covered by the various estimators. In every detail his work is identical with the regular reconnaissance work, except that he works very slowly and with maximum accuracy. All diameters are actually measured by Biltmore stick or calipers; the width of strip is paced out in all cases of doubt, and heights are constantly checked by measuring wind-fall or by hypsometer. Furthermore, the strips are run as nearly as possible over exactly the same ground as that covered by the original estimate, a mark being left at the end of each forty by the original compassman.

A comparative analysis is then made of the original sheet and of the check sheet on some such form as follows:

#### SAMPLE ANALYSIS SHEET—CHECK ESTIMATE

NE¼ SW¼, S. 13, T. 50, N. R. 4E. B. M.

#### Esimator, J. Smith

Species	Estimate	Check	Error	Pct. Error
W. Pine D. Fir	298 M 56 M	260 M 49 M	-38 M - 7 M	-14.6 -14.3
Total	354 M	309 M	-45 M	-14.5

#### White Pine

Diam. Group	No. o	f Trees	No. of	Logs	Logs per	Tree
15" and over   16" -20"   21" -25"   26" -30"   30" -	Est. 33 20 6 3 1	Check 31 21 5 2 2	Est. 59 82 35 24 9	Check 68 84 29 15 16	Est. 2.1 4.1 5.8 8.0 9.0	Check 2.2 4.0 5.8 7.5 8.0
Total -	63	61		1		1

#### Douglas Fir

Diam. Group	No. o	f Trees	No. of	Logs	Logs pe	r Tree
15" and over	Est. 20 17 10 6	Check 18 20 8 7	Est. 56 76 60 51	Check 50 89 49 56	Est. 2.8 4.5 6.0 8.5	Check 2.8 4.4 6.1 8
30" - /	$\frac{3}{56}$	$\frac{3}{56}$	$\frac{29}{1}$	$\lfloor \frac{24}{ } \rfloor$	9.7	8 -

#### Comment.

This check indicates:

Width of strip, O. K.

Diameter, O. K. Height O. K. up to about 25 inches, for larger trees too high.

8-16-12

H. JONES, Check Estimator.

#### APPLICATION OF SYSTEM.

Checks should be made at intervals depending on the experience of the crew. During the first two or three weeks after the training periods the check estimator should be kept continually at this work. Later, he may be used for the greater part of the time in routine estimating. Time may be saved by selecting for checking two forties cruised by different estimators which lie adjacent. The speed of check estimating, (including the analysis work), is about one-half that of the regular estimating work. Silvical data, logging data, cull per cents, etc., should be checked at the same time with the estimate and the compassman accompanying the check estimator should check for topographic detail.

#### CORRECTION FACTOR.

The application of a correction factor based upon the estimator's general impression that the strips run are a certain per cent above or below the general average of the 40, is very dangerous except in the case of the most experienced men. Even the more inexperienced estimators, however, can use it with advantage when its determination is arbitrary and mathematical, as in the following cases:

- 1. When the timbered area of a forty is broken by parks, burns, and other openings, the correction factor is the direct ratio between the timbered area in the forty and the timbered area covered by the estimate strip or strips
- 2. When different types containing nearly pure stands are traversed by the estimate strip, but when it is evident that the strip does not include an area within each type proportionate to the acreage of the type, the correction factor may be calculated in a manner similar to 1, separately for each species.
- 3. When the compassman makes gross errors in pacing the correction factor may be mathematically adjusted to compensate

Example 1: The compassman's map shows that 11 acres of a forty are grassland and 29 acres timbered, and that 15 chains of the double strip was run in the grassland and 25 chains in the timbered; timber area within strip 2.5 acres.

Example 2: The compassman's map shows that 5 acres of the forty is spruce type and 35 acres is lodgepole pine type, and that 8 chains of the single strip run was in spruce, and 12 chains in lodgepole pine. Area of spruce type in strip .8 acres; area of lodgepole pine type in strip 1.2 acres; correction factor spruce—5%—6.2; correction factor lodge pole pine—35—29.2

1.2

Example 3: A compassman falls 5 chains short of the section line on the far side of a section covered. The estimator tallies on through to the line. Obviously, the sheet for the last forty run contains too much timber at the expense of the first three forties. Assuming the error in pacing to be equally distributed, we have 85 of the compassman's chains equal to 80 true chains. Each of the first three sheets then covers 80x20 chains in length and the last is 80x(20+5) chains in length.

Area of strip first 3 forties  $=\frac{85}{80 \times 2}$ 

Area of strip last forty  $=\frac{85}{80 \times 2.5}$ 

Correction factor (in case of one strip to forty)= $\frac{40}{80 \times 2}$ =21.3 for first 3

forties, and 
$$80 \times 2.5 = 17.0$$
 for last forty.

In case two strips are run to the forty the actual area of each strip should be calculated separately and the two added, the sum being divided into 40. The following table gives the area of the sample strips in each of the first three and the last 40 in the case of various errors in pacing:

Chains paced	Acres in each of	Acres in
per mile	first three 40's	last 40
90	1.75	2.62
89	1.77	2.57
88	1.80	2.52
87	1.83	2.46
86	1.85	2.40
85	1.87	2.34
84	1.90	2.28
83	1.93	2.21
82	1.95	2.14
81	1.97	2.07
80	2.00	2.00
79	2.03	1.92
78	2.05	1.84
77	2.07	1.76
76	2.10	1.68
75	2.13	1.59
74	2.15	1.50
73	2.17	1.41
72	2.20	1.32
71	2.23	1.22
70	2.25	1.12

#### COST KEEPING SYSTEM AND FORMS.

The following special forms will be used for cost keeping on reconnaissance projects. These may be requisitioned from the District Office. In addition to these the standard Form 21 may be kept in the field. This will be totaled at the end of each month, and the food supplies on hand will be entered in red ink and deducted, a similar amount being carried forward to the next month. The special forms should be totaled and completed as soon as possible after the end of each month and filed in the Supervisor's office, a copy of the final summary sheet for the month only being forwarded to the District office.

#### CULL.

Cull is a very difficult matter for inexperienced men to handle. They may be largely assisted by the preparation of a table showing the average maximum and minimum cull per cent characteristic of a given region for each species, further divided by site, etc., if necessary. This table should be prepared from the best available information. An observant scaler who has worked in the region in question is probably best qualified to prepare it. The following table which was used on the Coeur d'Alene Forest will indicate the form such data may take.

FLAT.

			Average	Cull.			
W	hite	*Hemlock	Tamarack	*White	Red	Spruce	Cedar
Extreme maximum				Fir	Fir		
Extreme maximum	65	100	35	85	25	25	60
Average maximum	30	50	20	45	10	10	40
Average minimum	10	30	10	25	5	5	15
Extreme minimum	5	20	5	15	0	0	0
		s	LOPE.				
Extreme maximum	35	50	20	40	20	20	20
Average maximum	15	30	15	. 30	10	10	10
Average minimum	8	20	7	20	5	5	0
Extreme minimum	3	10	0	10	0	0	0

These cull per cents include both breakage and defects

#### DESCRIPTIONS OF TYPES.

Following are the descriptions of the types for which symbols are given in the instructions. In these descriptions the percentages given are percentages of the numerical proportion of the trees and not of the volume. The trees considered for this numerical proportion should in mature stands include all age classes which have definitely established themselves as a part of the stand and which therefore indicate its type. Ordinarily this will include pole and sapling growth but not seedlings.

The classification hereafter outlined is based upon the present composition of the stand, regardless of whether this composition is the ultimate cover of the site or merely a temporary cover resulting from some interference with natural conditions. Where a succession of types is known to occur, either the ultimate type, or one of the stages in the succession which, as far as can now be foreseen, will be perpetuated in forest management, may, if desired, be mapped or used for purposes of management in addition to the present cover.

#### TREELESS LAND.

There is no clear line of demarcation between trees and shrubs, and in this classification, which is purely for practical purposes, no attempt is made to draw a fine distinction between them. Accordingly, under "Treeless Land" are included two types, "Brush" and "Sagebrush," which are often composed partly or entirely of individuals having tree form, but so small and stunted that the types in which they occur are ordinarily classed as treeless.

Barren—An area too rocky, too exposed, too arid, or at too high an elevation to support trees or grass or more than a very scattering

<sup>\*</sup>Trees obviously defective not tallied.

growth of herbs and shrubs; and temporary barrens, areas repeatedly burned containing neither reproduction, grass, nor brush in appreciable quantities.

Grass—An area such as parks and mountain meadows, whose principal vegetation is grass and other herbs.

Cultivated—An area now under cultivation or lying fallow.

Sagebrush—An area whose principal vegetation is sagebrush.

Brush—All other areas the present cover of which is a stand of shrubs or stunted trees.

#### WOODLAND.

An area, usually at the lower altitudinal limits of tree growth, whose crop when mature is a stand of trees, ordinarily open, usually short, branchy, and crooked, most of which are fit only for cordwood, fencing, etc.

Juniper—A stand composed of approximately 80 per cent or more of any species of juniper, with very little or no pinion. Rocky mountain juniper is the chief species, usually with some limber pine, Western yellow pine, or Douglas fir.

#### TIMBERLAND.

An area whose crop when mature is a more or less dense stand of trees which may furnish sawlogs, ties, telegraph poles, etc.

Yellow Pine—A stand containing approximately 50 per cent or more of Western yellow pine. Usually on dry well-drained sites at the lower altitudinal limit of timberland or exposed south and southwest slopes at higher altitudes. The principal species in mixture are Douglas fir, Western larch, and lodgepole pine.

Western White Pine—A stand in which Western white pine is the key tree, forming approximately 15 per cent or more of the stand. In the northern part of the range of this type, at medium elevations, hemlock is the predominant tree, frequently outnumbering the white pine even in young stands; at higher elevations in the same region Engelmann spruce and Alpine fir are the chief associates. In the middle of its range white pine occurs nearly pure or with Douglas fir as its chief associate, and with hemlock, white fir, larch and sometimes lodgepole pine in mixture. In the southern part of the range of this type white pine is less important numerically than further north. Here in young stands white pine occasionally forms as much as 50 per cent of the stand or more, but usually the predominant trees of the type are white fir and cedar, with Douglas fir and larch in mixture, a little yellow pine on the drier knolls, and sometimes in young stands lodgepole pine.

Cedar-White Fir—The stand is composed of cedar and white or grand fir, the former nearly pure in patches, the latter predominant throughout with a considerable amount of Douglas fir, some yellow pine in groups on the knolls and as scattered individuals throughout and rare Western white pine individuals. The type occurs on the Selway and southern portion of the Clearwater National Forest south of the commercial range of white pine

Cedar-Hemlock-White Fir—Stands composed of cedar, hemlock and white or grand fir in varying proportions, with a little white pine, also Engelmann spruce, Alpine fir and rarely Douglas fir, areas which under management could be made to produce white pine in commercial quantities.

Lodgepole Pine—A stand containing approximately 50 per cent or more of lodgepole pine, usually nearly pure, but sometimes in mixture with other species. The principal species in mixture are Douglas fir, Engelmann spruce, Alpine fir and Western larch.

**Douglas Fir**—A stand containing approximately 60 per cent or more of Douglas fir, sometimes follows a temporary type of aspen. The principal species in mixture are yellow pine, lodgepole pine and Western larch. Usually at the lower or medium altitudes either at the lower limit of timberland or just above the yellow pine type. Occurs also on north slopes above the white pine type.

Larch-Douglas Fir—A stand containing approximately 60 per cent or more of Western larch and Douglas fir, with white or grand fir in mixture. Larch is the key tree. The proportion of larch varies greatly from very little to practically pure. The principal species in mixture is yellow pine, but occasionally with lodgepole pine, Western white pine, lowland fir, Western red cedar, or Western hemlock. Usually at medium elevations about the same as Douglas fir, but with more favorable site conditions. On less favorable sites than white pine.

Engelmann Spruce—A stand containing approximately 50 per cent or more of Engelmann spruce. Sometimes follows a temporary type of aspen. Engelmann spruce may be pure, but is more often in mixture with Alpine fir, lodgepole pine, limber pine and Douglas fir. Usually at the higher elevations and on the more moist sites.

Mountain Hemlock—A stand containing approximately 50 per cent or more of mountain hemlock (T. mertensiana). The principal species in mixture are Alpine fir, Engelmann spruce and Western white pine. Other species common in the mixture are whitebark pine, lodgepole pine, Alpine larch (L. lyallii) amabilis fir and Shasta fir. At the higher elevations usually near the upper limit of tree growth, areas of mountain hemlock not capable of producing merchantable stands should be included in the subalpine type.

Subalpine—A stand containing a varying mixture of subalpine species no one of which is abundant enough to throw the stand into any of the types already described or rarely pure stands. At the upper limit of tree growth, usually unmerchantable because of poor form and small size, and of value for protective purposes only. The principal species are Alpine fir, Engelmann spruce, lodgepole pine, whitebark pine, limber pine, mountain hemlock, and Alpine larch.

Legend—In designating land types, land classification, forest types, age classes and cut-over lands on the base map prepared by the field draftsman, symbols as given below will be used. In the preparation of land type, land class, forest type, age class, stand class and other maps to meet a specific need or for the administration of a particular phase of Forest business colors as given below will be used. The latter maps will be prepared on reproductions made by the District office from the base map. Size of areas to be shown on map as separate type covered under Map Data.

Standard Legends. (Using Color Tints).

Date	1	Classification and		Timber
of	Tint	Stand. Maps	Timber	Age-Class
Origin	No.	(Atlas Legend)	Type Maps	Maps
	2	Grassland	Grassland (G)	Grassland
1891-1910	10	New burn	Juniper (J)	2-21 yrs. (20)
1711-1750	15	Light 10-25 MBF	Yellow Pine (YP)	162-201 yrs. (200)
Prior to 1711	1	Dark 25-50 MBF	i 	Over 200 yrs.
	1			(200+)
	Indigo	Special	Mountain Hem-	Special
			lock (MH)	
1871-1890	23	Special	Cedar-white fir	22-41 yrs. (40)
	j   1	 	(C-WF)	
	5	Special	Cedar-hemlock-	Special
			White-fir (C-   H-WF)	
1751-1790	29 i	Light 2-5 MBF	•	122-161 yrs. (160)
1101 1100	20	Dark 5-10 MBF	boughes in (br)	122-101 , 15. (100)
	37	Sage Brush	Sage Brush (SB)	Sage Brush
	46		Cultivated Land	
			(C)	
1911-1930	58	Water	Engelmann	Present and next
ĺ			Spruce (ES)	decade (O)
1851-1870	62	Mineral Land	Larch-Douglas	42-61 yrs. (60)
			Fir (L-DF)	
1811-1830	63	Woodland, poles,	-	82-101 yrs. (100)
1501 1010	0.0	etc.	(LP)	
1791-1810	69	Less than 2 M.B.F.	White Pine (WP)	
1831-1850		Old Cuttings	Subalpine (SA)	62-81 yrs. (80)
	87	Brush	Brush (Bh)	Selection Forest
	300	Barren	Pouron (Du)	all ages (Z)
	300	Darren	Barren (Bn)	

#### OLD CUTTINGS.

Less than 1-3 of merchantable timber removed

1-3 to 2-3 merchantable removed

More than 2-3 merchantable timber removed

Higgins' red
Vertical hatching
Higgins' red
45° NE-SW
Higgins' red
45° NW-SE

(Cutover symbols are to be used only in case timber left in cutting still constitutes the predominant age class, not being applicable to areas where the reproduction is more important than the mature timber).

#### Cultivable Land

Doubtful cases may be indicated by

Burns

Higgins' red
Horizontal hatching
Higgins' red
Horizontal broken hatching
Higgins' black
Vertical hatching

(This symbol applicable only where merchantable dead timber is the material present of predominant importance. Where reproduction of a merchantable remnant of the mature stand is of predominant importance the area should be classed as the corresponding age class of the proper timber type).

Boundaries of Types and Age Classes, dotted lined...... Boundaries of areas of merchantable timber, dash and dotted lines, as

Reservoir Sites, Cultural Features, etc.—See "Signs, Symbols and Colors, 1912," issued in small booklet form.

Example: For a stand of timber in the white pine type 70 years old with .5 crown density the map would show this as follows: .5-WP—80. (The density is placed before type to avoid possible confusion in figures.)

Normality Description—Normality is the present condition of a stand discounted into terms of its expected yield at the end of the rotation. The term is most useful in such pure stands as lodgepole pine. Here it is considered that 1,000 seedlings per acre, well distributed, will result in the maximum production per acre. Less than this number results in reduced yield. More than this number has the same effect, through overcrowding and consequent reduction in growth.

The standard normality is 1.0. By a stand of .5 normality is meant one which is so understocked that it will by the end of the rotation, yield but half of what it could if properly stocked. By +.5 is indicated a stand which will yield the same amount but with this reduced yield the result of overcrowding. The following figures are indicative:

```
1500 per acre
.0
      300 per acre
                                    \perp .9
                                                        66
                                          2000
.5
       500
                                                   66
                                                        6.6
. 7
       700
                                          3000
                                     _.5
       900
             6.6
                                     _.3
                                          4000
.9
     1000
1.0
```

These figures refer to good distribution. Uneven distribution will lower the figures on understocked and raise them on overstocked areas. Uneven height growth will raise the figures on overstocked areas. All these figures are for the youngest age class and allowance must be made for older stands.

Determination of Streamflow in Cubic Feet per Second—The flow of a stream in cubic feet per second is easily obtained with sufficient accuracy for the purpose for which it is to be used as follows.

- (a) Estimate the average width and the average depth of the stream in feet.
- (b) Multiply the average width by the average depth to obtain the cross section area in square feet.
- (c) Estimate the velocity in feet per second at a point where the cross section area is approximately the average for some distance.
  - (d) A product of (b) and (c) is the flow in cubic feet per second.

Filing System—The first essential is a moisture and rodent proof box. The Forest Service metal filing case with its three card-board transfer cases serves admirably. The filing may be done in letter mail envelopes, five series of these to be kept as follows:

- 1. Incomplete work, arranged alphabetically by names of estimators and compassmen.
  - 2. Completed work.
- a. Maps arranged by township and section usually one envelope for each township is sufficient.
- b. Estimate and description sheets arranged by logging units. One envelope for each unit.
  - c. Summaries filed in separate envelopes by logging units
  - 3. Blank forms, etc.

Assignment of forties to the several estimators may be recorded on blank township plats by entering in each forty a key letter identifying the estimator to which it is assigned. When completed the estimate sheet is turned in, the total estimate shown should then be entered under the key letter. Key letters without estimates thus indicate incompleted work.

The above system applies to surveyed areas, but may be easily modified to apply to unsurveyed projects.

Equipment—The following lists of equipment and provisions have been planned for the average ten-man crew.

## LIST OF EQUIPMENT.

#### Instruments-

- 1 Transit, Gurley, Mountain, (Not always needed).
- 1 Level, Locks.
- 8 Barometers, Aneroid.
- 8 Levels, Abney.
- 6 Compasses, F. S. Standard.
- 6 Compasses, box pocket.
- 6 Registers, tally.
- 6 Cruisers sticks.
- 5 Tapes, diameter.
- 1 to 4 Tapes, steel, (preferably 2½ chains).
- 1 Slide Rule.
- 1 Sketching case.
- 1 Adding Machine.
- "T" Square, 24.
- 2 12' Scales, engineers'.
- 1 set drawing instruments.
- 1 Triangle, 45°.
- 1 Triangle, 30° and 60°.
- 1 Protractor.

Drawing ink-black, blue, red, orange.

Ink, fountain pen.

Pens, quill.

Pens, Gillott's No. 303.

Thumb Tacks, solid head, 6 doz.

Rubber bands.

Clips.

Blotters, small.

Wire No. 12, small amount, for setting up camp.

Nails.

## Boards for Drafting-

## Forms and Stationery, etc.-

Map books, Form No. 493.

Estimate books, Form 494.

.

Time slips.

Time books.

Summary Sheets.

1 case, ranger filing.

1 tatum folder.

1 file, collapsible.

Office note.

Yellow paper.

Envelopes.

Envelopes, Manila, 6"x81/2" for estimate sheets.

Envelopes, Manila, 9½"x12".

Ranger notebooks No. 289.

Pencils 4H.

Pencils No. 2.

Drawing paper. Cloth back.

Tracing cloth.

Tracing paper, thinnest grade.

## Tentage-

- 1 10"x12" (high wall) cook tent.
- 1 7"x9" commissary tent.
- 1 fly (large) mess tent.
- 1 10"x12" (high wall) drafting tent.
- 3 to 5, 7"x9" (wall tents) sleeping quarters

## Miscellaneous Equipment—

- 1 Map case, 10"x40"x6".
- 3 table tops (canvas on bed of  $2\frac{1}{2}$  inch slats closely laid).
- 2 Baldwin lamps, (acetylene).

## Provision List—Taken from Trail Manual 1913.

10 men for 10 days (100 rations).

Fl	our	100	lbs.
*C	ured Meats	75	46
P	otatoes	100	"
В	eans	20	"
**S1	ıgar	40	"
***La	ard	10	" in 5 lb. pails.
В	utter	10	" Creamery, 1 lb. cartons.
$\mathbf{D}_{1}$	ried Fruits	20	"
C	offee	10	" Good grade, ground 1 lb.
$\mathbf{R}$	ice	5	" sealed tins.
$\mathbf{T}$	ea	1	"
C	ocoa	2	" ½ lb. cans.
C	heese	5	44
$\mathbf{M}$	acaroni	2	46
M	iik	48	cans, Carnation grade.
С	orn Beef	5	" 2 lbs.
$\mathbf{T}$	omatoes	8	" 2½ lbs. solid pack.
P	eas	5	" 2 lbs. solid pack.
C	orn	10	" 1 lb. solid pack.
Sa	auer Kraut	4	" 3 lbs.
R	colled Oats	10	lbs.
О	nions	10	"
	*		

<sup>\*</sup>If fresh meat is available use 50 lbs., cured, 25 lbs. fresh.

<sup>\*\*</sup>If syrup is preferred, reduce sugar accordingly.

<sup>\*\*\*</sup>If fresh meat is used, increase lard to 15 lbs.

	Corn Meal	5	lbs.
	Graham Flour	5	66
	Pan Cake Flour	5	66
	Salt	3	66
	Baking Powder	3	46
	Soda	1	66
	Yeast Cake	1	Package.
	Eggs	10	Doz.
	Catsup	2	Bot.
	Pickles, sour	1	kit 2 gal.
	Mustard, ground	4	oz. can.
	Pepper, ground	8	66 66
	Cinnamon, ground	4	66 66
	Allspice, ground	4	66 66
	Lemon Ext	4	oz. Bot.
	Vanilla Ext.	4	66 66
	Vinegar	1	qt. Bot.
	Soap, faundry	5	lbs.
	Matches		five cent packages.
	Candles	2	lbs.
k	*Coal Oil	4	1 qt. bottles.

Dehydrated fruits and vegetables may be substituted for fresh fruits and vegetables in the ration of one pound of dried to seven pounds of fresh. The following dehydrated products are sometimes of great value in side or main camps:

Potatoes (riced). Cabbage. Spinach. Carrots. Onions. Turnips. Sweet corn. Green peas. String beans. Cranberries. Rhubarb. Blueberries Raspberries. Strawberries. Celery (ground). Leeks (ground).

It may be advisable to add certain articles to the above list to provide for the cold lunch feature of reconnaissance work.

Approximate total weight, 550 lbs.

" cost, \$65.00.

<sup>\*\*\*\*</sup>Coal oil will be replaced by carbide if Baldwin lamps are used.

Kitchen Outfit—(Taken from Trail Manual 1913). Crew of 10 men, including foreman and cook. 1 Lantern. 2 S. B. Axes. 1 Sheet steel cook stove No. 8, with 6 joints pipe. 4 Fry pans, assorted sizes. 2 Granite kettles, 12 qt., with covers 6 " 4 2 stew kettles, 6 qt., with covers. 1 Granite coffee pot, 8 qt. 1 Granite tea pot, 3 qt. 2 Dishpans, 14 qt. 1 Granite rice boiler, 6 in. 2 Dripping pans to fit oven of stove. 1 Can opener. 1 Rolling pin. 4 Tin wash basins. 4 Tin water pails, 10 qt. 3 Tin dippers, 1 qt. 1½ doz. Granite plates. 1½ doz. cups and saucers. dish up basins, 2 qt. ½ doz. " " 1 at. 6.6 ½ doz. 1 doz. Mush bowls. 1 Granite syrup pitcher, 1 qt. " cream pitcher, 1 qt. 1 2 Butcher knives, 1-10 in., 1-12 in. steel. 1 Meat fork. 2 Granite stirring spoons. 1 Meat saw. 4 Tin milk pans, 6 qt. 1½ doz. Wood handled steel knives and forks.  $1\frac{1}{2}$  doz. Teaspoons. 1½ doz. Tablespoons. 5 1-Gal slop cans, galvanized iron. \*5 yds. 12 oz. ducking or light canvas, 36 in. wide.

 $\frac{1}{2}$  lb. 10 oz. tacks.

10 lbs. Assorted nails.

1 Carpenter's hammer.

1 " hand saw.

1 Alarm clock.

10 yds. Crash towling.

10 yds. Unbleached muslin.

Approximate total weight 325 lbs.

Approximate total cost \$62.00.

\*This item is intended to be used for tops for table frames built of light poles and is already covered under miscellaneous equipment.

The tin pails may be replaced by canvas pails, and one pitcher each for milk and syrup added.

#### SUMMARY SHEET FORMS.

The sample summaries here given are adopted in the effort to secure direct utilization of all data collected in the field.

In case of the sample summary of silvical data the first table only is prepared with mathematical accuracy, the acreage figures under type and age class being accurately obtained from the map. The other figures of this summary and of the logging data summary are comparatively rough approximations, the field sheets and maps being used to check and supplement the personal knowledge of the chief.

Summaries of estimate data by logging units and probable timber sale chances will be made as indicated in the sample summary sheet form.

It is evident that it will be necessary to determine the average stand per acre by species for certain type and age classes, within the logging chance for use in connection with appraisal and marking. The estimates should therefore be further summarized in the following manner:

When such demands can be anticipated the estimates should be further summarized in the following manner:

A certain number of estimate sheets within each age class of each type will be selected, and the estimates for the average sample acre obtained in each case. The special age classes and types here distinguished must be determined with reference to the marking plans for the logging chance under consideration.

These results may be tabulated as below (j—r) together with acreage figures (a—i). Figures representing total calculated volume (aj—ir) are then directly obtained and the ratio between this total for the whole chance and the actual total estimate for the whole chance S easily secured. This ratio applied as a correction factor to the sep—S' arate calculated total volumes for each species of each age class of each type will give the stand by species for age class and type of the logging chance with sufficient accuracy to meet the needs of the marking plans. Figures for the average acres may be then obtained by division. In the tabulation given below it is to be noted that several species will normally appear under each age class of each type.

## LOGGING CHANCE.

Type	Age Classes (By species)	Acres summary from silvical data	Volume per A. From representative estimate sheets	Total cal. vol.	Actual Est. From est. summary of unit	Calculated estimates corrected	Stand per A.
A	1	a	j	aj		aj.S	js
•	2	b	k	bk		S' bk.S S'	S' ks S'
	3	c	1	cl		cl.S	ls
В	1	đ	m	dm		S' dm.S	S ms S'
	2	e	n	en		S' en.S	ns
	3	f	О	fo		fo.S	S' os
С	1	g	p	gp		gp.S	S' ps
	2	h	$\mathbf{q}$	hq		S' hq.S	S' qs
	3	i	$\mathbf{r}$	ir		S' ir.S	S' rs
						S'	S'

Total for chance

S' S

SAMPLE SUMMARY OF ESTIMATES

(To be used for each logging unit and also for the probable timber sale chance as a whole.) Smith Creek Logging Unit

Species	Total stand M. bd. ft.	Cull %	Stand per A. M. b. ft.	%	No. Logs	Logs per M.	No. Trees	Logs per Tree	25	Poles 30	භ ය
White Pine 10"-28"	12,000	10	4.0	16	48,000	4	6,000	~			
30" and over	8,000		6.0	24	80,000	10	16,000	ro	•	•	
Cedar	5,000	15	2.5	10	40,000	∞_	10,000	4	10,000	5,000	5,000
West. Fir Sound	10,000	10	5.0	20	100,000	10	20,000	ಚ			
Defective	15,000	40	7.5	30	150,000		30,000				1
Totals	50,000		25.0	100	418,000	8.4	82,000	rc	10,000	5,000	5,000

#### SAMPLE SUMMARY.

## Logging Data, Smith Creek.

Cutting and Skidding Factors—Surface: 80% smooth; 20% rough, (concentrated in section 18, north of creek).

Soil: 100% firm.

Rock: Continuous ledges about 20 feet high are found on north side of creek in sections 18 and 19. Small areas of slide rock in section 7, not affecting logging seriously.

Underbrush: W. P. 200 —. Hemlock, white fir, and yew of moderate density, averaging 10 feet in height, covering 40% of area. W. P. 80-160, inc., hemlock and white fir, density, light, covering less than 10% of area. (Etc. for other types and age classes).

Windfall: Light, 10% of area (section 7) average diameter 6", moderate, 70% of area average diameter 10". Heavy, 20% of area average diameter 10".

## Transportation Factors—Draws—Soil 100 % firm.

Rock: Lower 100 yards of draws coming into creek from north in sections 18 and 19 become narrow canyons cut 20 feet into the ledge rock; some slide rock in section 7. Not a factor elsewhere.

Underbrush—60% moderate. 40% light. Of little importance as transportation factor.

Windfall—Moderate and of 20" material. 50% of area; heavy and of 12" material. 50% of area.

Streams—Main Smith Creek has a flow of approximately 10 cubic feet per second. A regular gradient of about 2%. Its average width varies from 7 to 8 feet at the Forks to 20 feet at its confluence with Jones Creek. The banks are good for driving. (Important branch streams to be treated in similar manner).

Stream Bottoms—Soil: 70% firm. 30% soft. (in section 19, S½).

Rock. None that hinders road building.

Underbrush: Heavy, 50%; moderate, 50%.

Windfall: Heavy and of 15" material, 60%; moderate and of 10" material, 40%. Min. width of main stream bottom 70 feet. North branch 30 feet for 1½ miles, south branch 20 feet for 1 mile then 10 feet for ½ mile.

Miscellaneous—There is an excellent dam site in section 7, requiring about 100 feet of wing construction.

## SAMPLE SUMMARY SILVICAL DATA FLAT CREEK. Types and Age Classes.

Type	Av. Density	Age Class	Area
W. P.	.7	20	100
66 66	.5	. 60	200
66 66	.3	160	400
66 66	.1	200	1800
"		All	2500
D. F.	.3	120	400
66 66	.3	160	200
66 66		All .	600
L.P.	.4	120	300 300
		Total,	3400

## CONDITION OF STAND.

Thrifty: W. P. 20 & 60.

D. F. 120 (about 50%).

Mature: W. P. 160.

D. F. 120 (about 50%).

D. F. 160.L. P. 120.

Decadent: W. P. 200 +

Total acreage, thrifty, 500; mature, 1100; decadent, 1800.

## DAMAGE.

Fire: About 200 acres in W. P. 200 \(\preceq\) and 50 in D. F. 160, 80% of trees damaged.

Insects: Bark beetles reported generally throughout W. P. 160 and 2004. Special examination urgent.

## Clear Length.

Type	Age	Species	Clear Length
W. P.	160	W. P.	2
		D. F	1
		L	g
	200	W. P	5
		D. F	2
		L	6
D. F.	120 & 160	D. F	1
L. P.	120	L. P	1

#### Soil

Type	Age	Soil.
W. P.	All	Sand-loam, fresh; moderate to deep.
D. F.	All	" dry, shallow to moderate.
L. P.	All	66 66 66 66

#### Rock.

Granite formation underlies almost whole area. About a section of limestone at extreme north end, in W. P. Type.

#### Undergrowth.

Type	Age	Density	Per Cent Area
W. P.	20	Open	5
	60	Open	5
	160	Open	5
	200	Open	50
D. F.	120	Medium	15
	160	Close	25
L. P.	120	Open	5

## Young Growth.

Type	Age	No. Per. A.	Species	Per Cent	Distribution
W.P.	20	2,000	W. P. 20;	I. 40; W. P. 40.	Singly
W. P.	60	600	W. P. 50;	L. 30; W. F. 20.	Singly

## VARIATION IN METHODS.

The Chief of Party may find the following suggestions helpful when special conditions are encountered.

#### THE QUARTER ACRE CIRCULAR PLOT.

In stands of timber of small value scattered over large areas, a one-man crew may be used to good advantage for mapping and estimating. The estimating may be most effectively done in such a case by the taking of one quarter acre circular plots approximately 60 feet in radius at two and one-half chain intervals. The area covered by such a tally will be equivalent to a strip one chain in width.

#### GROUP TALLYING.

In timber which is characteristically uniform in size within one or two ranges of d. b. h. each range having differences limited to 6-10 inches and where few species are concerned the following method has been found of value in increasing the speed and conserving the judgment of the estimator. All the trees on the strip are counted, but only a certain proportion (as one in five) of them are individually sized up and tallied. The first 20 trees on a strip may be counted without tally and the next five trees nearest the estimator tallied five times each by species d. b. h. and log length. If there are two distinct sizes they may be treated separately, two counts being carried simultaneously by the estimator, or each tree of the larger size may be tallied and the smaller size tallied by groups.

Broken Tally—The tally on a strip is sometimes taken only at regular intervals arbitrarily determined. This rectangular plot method results in relief to the estimator and has some of the advantages of the circular plot method. It is considered preferable to making a reduction in the width of the strip below the minimum of one chain but is seldom, if ever, to be used by any but one-man crews.

Variation in Width of Strip—In open stands of valuable timber it is sometimes possible to secure the best results by the use of a broad strip, perhaps two chains in width. In certain cases this will double the per cent of the stands tallied with little or no reduction in the length of strip which can be run per day. The advisability of using a strip of width greater than one chain should be carefully considered before estimating open stands of yellow pine and larch.

The Use of Chain by Estimating Crew—When it is found impracticable to have control lines within reliable pacing distance of each other and when the Abney is used for elevation control, it will be found necessary to use the chain. A steel tape two or two and one-half chains in length is recommended.

## MULTIPLE VOLUME TABLE—WESTERN WHITE PINE

Values from 40" to 60" D. B. H. assumed.

(Constructed by the Frustum Form Factor method. Based on 306 trees from the Coeur d'Alene, St. Joe and Lolo National Forests.)

Scribner Decimal C Rule.

DBH	Logs	1	2	3	4	5	6	7	8	9
8	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{array}{c} 2.5 \\ 5 \\ 7.5 \end{array}$	$\begin{bmatrix} 5\\9.5\\15 \end{bmatrix}$	$ \begin{array}{c} 8 \\ 14.5 \\ 22.5 \end{array} $	$\begin{array}{c} 10 \\ 19 \\ 30 \end{array}$	$egin{array}{c c} 12.5 \\ 24 \\ 37.5 \\ \end{array}$	$\begin{bmatrix} 15 \\ 29 \\ 45 \end{bmatrix}$	17.5 $33.5$ $52.5$	$   \begin{array}{c c}     20 \\     38.5 \\     60   \end{array} $	20 43 67.5
10	$egin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{bmatrix} 2.5 \\ 5 \\ 9 \end{bmatrix}$	$egin{array}{c} 5.5 \ 10.5 \ 17.5 \ \end{array}$	$egin{array}{c} 8 \\ 15.5 \\ 26.5 \\ \end{array}$	$\begin{array}{c} 11 \\ 21 \\ 35.5 \end{array}$	$\begin{bmatrix} 13.5 \\ 26 \\ 44.5 \end{bmatrix}$	$\begin{bmatrix} 16\\31\\53 \end{bmatrix}$	$\begin{array}{c} 19 \\ 36.5 \\ 62 \end{array}$	$21.5 \\ 41.5 \\ 71$	$\begin{bmatrix} 24 \\ 47 \\ 79.5 \end{bmatrix}$
12	$egin{array}{c} 4 \ 1 \ 2 \end{array}$	$\begin{array}{c} 12.5 \\ 3 \\ 6 \end{array}$	$\begin{bmatrix} 24.5 \\ 6 \\ 12 \end{bmatrix}$	$\frac{37}{8.5}$	49 11.5 24	$61.5 \\ 14.5 \\ 30$	$\begin{bmatrix} 74 \\ 17.5 \\ 36 \end{bmatrix}$	86 20 42.5	$98.5 \\ 23 \\ 48.5$	$egin{array}{c c} 111 \\ 26 \\ 54.5 \\ \end{array}$
	3 4 5	10.5 $15$ $19.5$	21 30 39	31 45 59	$41.5 \\ 60.5 \\ 78.5$	$\begin{bmatrix} 52 \\ 75.5 \\ 98 \end{bmatrix}$	$\begin{array}{c} 62.5 \\ 90.5 \\ 118 \end{array}$	$73 \\ 106 \\ 137.5$	$\begin{array}{c c} 83 \\ 121 \\ 157 \end{array}$	$\begin{bmatrix} 93.5 \\ 136 \\ 177 \end{bmatrix}$
14	$egin{pmatrix} 6 \ 1 \ 2 \ \end{bmatrix}$	24 3 7	48.5 6 14	$\begin{array}{c} 72.5 \\ 9 \\ 21 \end{array}$	$96.5 \\ 12.5 \\ 28$	$121 \\ 15.5 \\ 35$	$ \begin{array}{c c} 145 \\ 18.5 \\ 42.5 \end{array} $	$169.5 \\ 21.5 \\ 49.5$	$   \begin{array}{r}     193.5 \\     25 \\     56.5   \end{array} $	$\begin{bmatrix} 218 \\ 28 \\ 63.5 \end{bmatrix}$
	3 4 5	$   \begin{array}{c c}     13 \\     18.5 \\     25   \end{array} $	$ \begin{array}{c c} 26.5 \\ 37 \\ 49.5 \end{array} $	$   \begin{array}{r}     39.5 \\     56 \\     74.5   \end{array} $	$53 \\ 74.5 \\ 99$	$\begin{bmatrix} 66 \\ 93 \\ 124 \end{bmatrix}$	79 $111.5$ $149$	$92.5 \\ 130 \\ 173.5$	$ \begin{array}{c c} 105.5 \\ 149 \\ 198.5 \end{array} $	$\left \begin{array}{c} 119 \\ 167.5 \\ 223 \end{array}\right $
	6 7 8	$ \begin{array}{c c} 31 \\ 36.5 \\ 42.5 \end{array} $	$\begin{bmatrix} 61.5\\ 73\\ 85 \end{bmatrix}$	$\begin{array}{c c} 92.5 \\ 109.5 \\ 127.5 \end{array}$	$   \begin{array}{r}     123 \\     146 \\     170   \end{array} $	$egin{array}{c} 154 \ 182.5 \ 225 \ \end{array}$	$   \begin{array}{c c}     185 \\     219 \\     255   \end{array} $	$216 \\ 255.5 \\ 298$	$ \begin{array}{ c c c c c } 246.5 \\ 292 \\ 340 \end{array} $	$\begin{bmatrix} 277 \\ 328 \\ 383 \end{bmatrix}$
16	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{array}{c} 3.5 \\ 8.5 \\ 16 \end{array}$	$\begin{bmatrix} 7\\17\\32 \end{bmatrix}$	$\begin{array}{c} 11\\26\\47.5\end{array}$	$14 \\ 34.5 \\ 63.5$	$ \begin{array}{c c} 17.5 \\ 43 \\ 79.5 \end{array} $	$egin{array}{c c} 21 \\ 51.5 \\ 95.5 \\ \end{array}$	$\begin{array}{c c} 24.5 \\ 60 \\ 111 \end{array}$	$\begin{bmatrix} 28 \\ 69 \\ 127 \end{bmatrix}$	$\begin{bmatrix} 31.5 \\ 77.5 \\ 143 \end{bmatrix}$
	4 5 6	$ \begin{array}{r} 23.5 \\ 30.5 \\ 38.5 \end{array} $	$\begin{array}{c c} 46.5 \\ 61 \\ 77 \end{array}$	$\begin{array}{c} 70 \\ 91.5 \\ 116 \end{array}$	$   \begin{array}{r}     93 \\     122 \\     154.5   \end{array} $	$\begin{array}{ c c c c }\hline 116.5 \\ 152.5 \\ 193 \\ \hline \end{array}$	$\begin{bmatrix} 140 \\ 183 \\ 231.5 \end{bmatrix}$	$   \begin{array}{r}     163 \\     213.5 \\     270   \end{array} $	$egin{array}{c} 186 \\ 244 \\ 309 \\ \end{array}$	$egin{bmatrix} 210 \\ 275 \\ 347 \end{bmatrix}$
18	8 1	46 54 4	$\begin{bmatrix} 92.5 \\ 108 \\ 8 \end{bmatrix}$	$   \begin{array}{r}     139 \\     162 \\     11.5   \end{array} $	$egin{array}{c} 185 \ 216 \ 15.5 \ \end{array}$	$egin{array}{c} 231.5 \\ 270 \\ 19.5 \\ \end{array}$	$egin{array}{c} 278 \\ 324 \\ 23.5 \\ \end{array}$	$   \begin{array}{r}     324 \\     378 \\     27.5   \end{array} $	$\begin{vmatrix} 370 \\ 432 \\ 31 \end{vmatrix}$	417 486 35
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	$\begin{bmatrix} 10 \\ 19 \\ 29 \end{bmatrix}$	$ \begin{array}{ c c c } \hline 20 \\ 37.5 \\ 57.5 \end{array} $	$   \begin{array}{c}     30 \\     56 \\     86.5   \end{array} $	$egin{array}{c} 40 \\ 75 \\ 115 \\ \end{array}$	$\begin{array}{ c c c }\hline 50 \\ 94 \\ 144 \\ \end{array}$	$egin{array}{c c} 60 \\ 112.5 \\ 173 \\ \end{array}$	$\begin{bmatrix} 70 \\ 131 \\ 202 \end{bmatrix}$	$egin{array}{c} 80 \\ 150 \\ 230 \\ \end{array}$	$\left \begin{array}{c}90\\168.5\\259\end{array}\right $
	5 6 7	$\begin{vmatrix} 38 \\ 46.5 \\ 57 \end{vmatrix}$	$ \begin{array}{c c} 75.5 \\ 93 \\ 113.5 \end{array} $	$\begin{array}{c c} 113.5 \\ 139.5 \\ 170.5 \end{array}$	$egin{array}{c} 151 \\ 186 \\ 227 \\ \end{array}$	$ \begin{array}{ c c c } 189 \\ 232.5 \\ 284 \end{array} $	$egin{array}{c c} 227 \\ 279 \\ 341 \\ \end{array}$	$egin{array}{c} 265 \ 325 \ 397 \ \end{array}$	$\begin{vmatrix} 302 \\ 372 \\ 454 \end{vmatrix}$	$\begin{vmatrix} 340 \\ 420 \\ 510 \end{vmatrix}$
20	8 1 2	$\begin{array}{ c c } & 66 \\ & 4.5 \\ & 12 \end{array}$	$ \begin{array}{ c c c c } \hline 132.5 \\ 8.5 \\ 24 \\ \end{array} $	$ \begin{array}{c c} 199 \\ 13 \\ 35.5 \end{array} $	$\begin{bmatrix} 265\\17\\47.5\end{bmatrix}$	$\begin{vmatrix} 331 \\ 21.5 \\ 59 \end{vmatrix}$	$\begin{bmatrix} 398 \\ 26 \\ 71 \end{bmatrix}$	464 30 83	$\begin{bmatrix} 530 \\ 34.5 \\ 95 \end{bmatrix}$	$\left  \begin{array}{c} 596 \\ 39 \\ 106.5 \end{array} \right $
	3 4 5	$\begin{bmatrix} 23.5 \\ 34 \\ 46 \end{bmatrix}$	$\begin{array}{ c c c }\hline 46.5 \\ 68.5 \\ 91.5 \\\hline \end{array}$	$egin{array}{c} 70 \\ 102.5 \\ 137.5 \\ \end{array}$	$   \begin{array}{c c}     93 \\     137 \\     183   \end{array} $	$  \begin{array}{c} 118 \\ 171 \\ 229 \end{array}  $	$egin{array}{c} 141.5 \\ 205 \\ 275 \\ \end{array}$	$egin{array}{c c} 165 \\ 239 \\ 321 \\ \end{array}$	$ \begin{array}{ c c c } 189 \\ 273.5 \\ 367 \end{array} $	$\left \begin{array}{c} 212 \\ 308.5 \\ 412 \end{array}\right $
	6 7 8	58 68.5 81	$ \begin{array}{c} 115.5 \\ 137 \\ 162 \\  \end{array}$	$ \begin{array}{ c c c c } \hline 173 \\ 205.5 \\ 243 \end{array} $	$egin{array}{c} 231 \\ 274 \\ 324 \\ \end{array}$	288   343   405	$\begin{vmatrix} 346 \\ 412 \\ 486 \end{vmatrix}$	$egin{array}{c} 404 \\ 480 \\ 567 \\ \end{array}$	462   548   648	$\left \begin{array}{c}520\\616\\730\end{array}\right $

## MULTIPLE VOLUME TABLE—WESTERN WHITE PINE

			ī - 1		·				_	
DBH	Logs	1	2	3	4	5	6	7	8	9
22	$\frac{1}{2}$	5 13	$\frac{9}{27}$	14	19 54	24 68	28	33 95	38 109	$\begin{array}{ c c }\hline & 43\\ 122\\ \end{array}$
		27	54	82	$\frac{109}{102}$	$\frac{136}{1902}$	$\frac{163}{244}$	191	218	245
	5	41 55	$\begin{array}{ c c c }\hline 81\\110\\ \end{array}$	$\begin{array}{ c c c }\hline 122\\165\end{array}$	$\begin{array}{ c c c }\hline & 163 \\ & 220 \\ \end{array}$	$\begin{array}{ c c c }\hline 203 \\ 275 \\ \end{array}$	244	285 385	$\begin{array}{ c c c c }\hline 326 \\ 440 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 366 \\ 495 \\ \end{array}$
	6	69	138	207	276	$3\overline{45}$ .	414	473	552	620
	7	84	168	252	336	420	504	587	670	755
	8 9	$\begin{array}{c} 97 \\ 112 \end{array}$	$\begin{array}{ c c c }\hline 195 \\ 224 \\ \end{array}$	$\begin{bmatrix} 292 \\ 336 \end{bmatrix}$	390	487 560	584 672	682 784	780 896	876 1008
$\overline{24}$	1 -1	5	10	15	21	$\frac{1}{26}$	$\frac{1}{31}$	36	$\frac{ 330 }{ 42 }$	47
	$\frac{2}{3}$	16	33	49	66	82	99	115	132	148
		32	$\frac{64}{5}$	96	$\frac{127}{100}$	159	191	223	255	287
	4 5	48 65	$\begin{array}{c c} 97 \\ 131 \end{array}$	$\begin{array}{ c c c c }\hline 145\\196\end{array}$	$\begin{array}{ c c c c }\hline 193 \\ 262 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 242\\327\end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	339 475	388 524	$\begin{bmatrix} 436 \\ 588 \end{bmatrix}$
	6	82	164	246	328	410	492	574	657	738
	7	97	195	293	391	488	586	684	782	879
	8 9	$\begin{array}{c} 116 \\ 132 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	348	$\begin{array}{ c c c }\hline 464\\527\\\hline\end{array}$	580 659	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	812 923	928	1045
26	1	5	11	$\begin{vmatrix} 390 \\ 17 \end{vmatrix}$	$\frac{1}{2}$	$\frac{1039}{28}$	$\frac{1}{3}$	$\frac{1923}{39}$	$\frac{ 1052}{ 45}$	$\begin{vmatrix} 1185 \\ \hline 50 \end{vmatrix}$
20	$\frac{1}{2}$	18	36	54	72	90	108	127	145	163
		37	74	111	148	185	1 222	259	296	333
	4	55	111	167	223	278	334	390	445	500
	5 6	$\begin{bmatrix} 77 \\ 94 \end{bmatrix}$	155 189	$\begin{array}{c c} 232 \\ 283 \end{array}$	$\begin{array}{ c c c c }\hline 310 \\ 378 \\ \end{array}$	387	465 566	542 662	$\begin{array}{ c c }\hline 620\\ 755\\ \end{array}$	695 850
	7	115	230	345	460	575	690	805	920	1035
	8	133	266	399	532	665	798	931	1065	1200
28	$\frac{1}{1} - \frac{9}{2}$	$\begin{array}{ c c c }\hline 153 \\ \hline 20 \\ \hline \end{array}$	$\begin{array}{r r} 306 \\ \hline 41 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{\mid 612}{\mid 83}$	$\begin{array}{r r} 1765 \\ \hline 103 \end{array}$	$\begin{array}{r r} 918 \\ \hline 124 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{r r}  1225 \\ \hline  165 \end{array}$	$\begin{array}{r r}  1375 \\ \hline  186 \end{array}$
48	$\frac{2}{3}$	$\begin{array}{c} 20 \\ 42 \end{array}$	85	127	170	$\begin{vmatrix} 103 \\ 212 \end{vmatrix}$	$\begin{array}{c c} 124 \\ 255 \end{array}$	298	$\begin{vmatrix} 165 \\ 350 \end{vmatrix}$	383
	4	64	129	193	258	322	387	451	516	580
	5	87	174	261	348	435	522	609	696	783
	$\frac{6}{7}$	$\begin{array}{ c c }\hline 109\\132\\ \end{array}$	$\begin{array}{ c c c c }\hline 218 \\ 264 \\ \end{array}$	$\begin{array}{c c} 328 \\ 396 \end{array}$	438 528	547	$\begin{array}{ c c c }\hline 656 \\ 792 \\ \end{array}$	$\begin{array}{ c c c }\hline 765 \\ 924 \\ \end{array}$	875 1055	$\begin{vmatrix} 985 \\ 1189 \end{vmatrix}$
	8	156	312	468	$\frac{1}{624}$	780	936	1092	1248	11404
	9	179	358	537	716	895	1074	1253	1432	1611
30	$\frac{2}{2}$	$\frac{23}{47}$	46	69	93	116	139	162	186	209
	3 4	$\frac{47}{72}$	94	$\begin{array}{c c} 141 \\ 216 \end{array}$	188	235	282	329	376 576	423 648
	5	100	200	300	400	500	600	700	800	900
	6	124	248	372	496	620	744	868	992	11116
	7 8	$\begin{array}{c c} 152 \\ 176 \end{array}$	$\begin{array}{c c} 304 \\ 351 \end{array}$	456   530	608   706	760   883	913	$\begin{array}{c}  1064 \\  1235 \end{array}$	$\begin{vmatrix} 1216 \\ 1410 \end{vmatrix}$	$\begin{array}{c}  1368 \\  1590 \end{array}$
	9	201	$\begin{array}{c c} \hline +351 \\ \hline +402 \end{array}$	603	804	1005	$\begin{array}{r r} 1000 \\ \hline 1206 \end{array}$	$\frac{ 1233 }{ 1407 }$	$\frac{ 1410 }{ 1610 }$	$\frac{11330}{ 1810}$
32	3	55	111	166	222	277	333	388	444	499
_	4	83	167	250	333	416	500	583	666	750
	$\begin{array}{c c} 5 \\ 6 \end{array}$	$\begin{array}{c c} 113 \\ 142 \end{array}$	$\begin{array}{ c c c }\hline 226 \\ 284 \\ \end{array}$	338 425	$\begin{vmatrix} 452 \\ 567 \end{vmatrix}$	$\begin{array}{c c} 564 \\ 710 \end{array}$	676   851	$  790 \\   993$	$\begin{array}{c} 902 \\ 1135 \end{array}$	$\begin{vmatrix} 1015 \\ 1275 \end{vmatrix}$
	7	$\begin{vmatrix} 142\\170\end{vmatrix}$	340	510	680	850	$\begin{vmatrix} 331 \\ 1020 \end{vmatrix}$	1190	$\begin{vmatrix} 1133 \\ 1360 \end{vmatrix}$	$\begin{vmatrix} 1273 \\ 1530 \end{vmatrix}$
	8	198	397	595	794	993	1190	1390	1588	1785
	9	229	458	687	916	1145	1375	1605	1835	2060
	10	258	515	773	1030	1288	1545	1800	2060	2320

# MULTIPLE VOLUME TABLE—WESTERN WHITE PINE Number of Trees.—Continued.

DBH	Logs	1	2	3	4	   5   	6	7	8	9
34	3 4 5	$\begin{bmatrix} 60 \\ 94 \\ 124 \end{bmatrix}$	121 188 248	$egin{array}{c c} 182 \\ 283 \\ 373 \\ \end{array}$	$\begin{bmatrix} 243 \\ 377 \\ 496 \end{bmatrix}$	$\begin{vmatrix} 303 \\ 472 \\ 621 \end{vmatrix}$	364 566 745	725 660 870	$\begin{vmatrix} 485 \\ 755 \\ 994 \end{vmatrix}$	546 850 1118
	6 7 8	$\begin{vmatrix} 157 \\ 188 \\ 223 \end{vmatrix}$	315   378   446	472 566 670	$egin{array}{c c} 630 \\ 755 \\ 893 \\ \hline \end{array}$	$\begin{vmatrix} 786 \\ 944 \\ 1115 \end{vmatrix}$	$\begin{vmatrix} 945 \\ 1132 \\ 1340 \end{vmatrix}$	$egin{array}{c} 1100 \\ 1320 \\ 1560 \\ \end{array}$	$\begin{vmatrix} 1258 \\ 1510 \\ 1785 \end{vmatrix}$	$   \begin{vmatrix}     1415 \\     1700 \\     2010   \end{vmatrix} $
36	$ \begin{vmatrix} 9 \\ 10 \\ 3 \end{vmatrix} $	255 288 67	$egin{array}{c c} 510 \\ 577 \\ 134 \\ \end{array}$	$egin{array}{c} 765 \\ 866 \\ 201 \\ \hline \end{array}$	$egin{array}{c} 1020 \\ 1152 \\ 268 \\ \end{array}$		$ 1530  \\  1730  \\  402 $	$\begin{vmatrix} 1785 \\ 2020 \\ 468 \end{vmatrix}$	$\begin{vmatrix} 2040 \\ 2305 \\ 536 \end{vmatrix}$	$\begin{vmatrix} 2300 \\ 2600 \\ 603 \end{vmatrix}$
0 U	1 4 5	101 136	$\begin{bmatrix} 202 \\ 272 \end{bmatrix}$	3 0 3 4 0 8	404 544	505	606 816	$\begin{array}{ c c }\hline 707\\952\end{array}$	808	$\begin{array}{ c c c c c }\hline 1909 &  \\\hline 1225 &  \\\hline \end{array}$
	6 7 8	$\begin{array}{ c c c }\hline 174 \\ 210 \\ 241 \\ \hline \end{array}$	348 420 482	522 630 724	$ \begin{vmatrix} 695 \\ 840 \\ 965 \end{vmatrix} $	$egin{array}{c} 870 \\ 1050 \\ 1205 \\ \end{array}$	1042  1260  1445	1215  1470  1685	$   \begin{array}{c c}     1390 \\     1680 \\     1930 \\   \end{array} $	1562 1890 2170
38	$\begin{bmatrix} -&9\\10\\3\end{bmatrix}$	$egin{array}{c} 279 \ 316 \ 74 \ \end{array}$	$ \begin{vmatrix} 558 \\ 632 \\ 147 \end{vmatrix} $	$\begin{vmatrix} 836 \\ 950 \\ 241 \end{vmatrix}$	$egin{array}{c}  1115 \\  1265 \\  295 \\  \end{array}$	$     \begin{array}{r}                                     $	$     \begin{array}{r}                                     $	$ \begin{array}{c c}  1950 \\ \hline  2210 \\  516 \end{array} $	$ \begin{vmatrix} 2230 \\ 2530 \\ 590 \end{vmatrix} $	$\begin{vmatrix} 2510 \\ 2840 \\ 664 \end{vmatrix}$
	4   5   6	$ \begin{array}{c c} 110 \\ 150 \\ 189 \end{array} $	$egin{array}{c} 220 \\ 300 \\ 378 \\ \end{array}$	$egin{array}{c} 330 \\ 450 \\ 567 \\ \hline \end{array}$	440   600   756	550   750   945	$  660 \\   900 \\   1135$	770 $  1050 $ $  1325$	$egin{array}{c} 880 \\ 1200 \\ 1512 \\ \end{array}$	$\begin{vmatrix} 990 \\ 1350 \\ 1700 \end{vmatrix}$
	7   8   9	$\begin{bmatrix} 226 \\ 261 \\ 306 \end{bmatrix}$	$egin{array}{c c} 452 \\ 522 \\ 613 \end{array}$	$egin{array}{c c} 678 \\ 784 \\ 920 \\ \end{array}$	$egin{array}{c} 905 \\ 1045 \\ 1225 \\ \end{array}$	$ \begin{vmatrix} 1130 \\ 1305 \\ 1530 \end{vmatrix} = -$	1355  $ 1565 $ $ 1840 $	1580 - 1825 - 12140	$   \begin{array}{c}      1810 \\      2090 \\      2450   \end{array} $	$\begin{vmatrix} 2035 \\ 2350 \\ 2760 \end{vmatrix}$
40	$\begin{array}{ c c c c }\hline & 10 \\ \hline & 4 \\ \hline & 5 \\ \hline \end{array}$	$\begin{array}{ c c c c }\hline 1346 \\\hline 122 \\\hline 165 \\\hline \end{array}$	$ig  \begin{array}{r} 692 \\ \hline 244 \\ \hline 330 \\ \end{array}$	$egin{array}{c}  1038 \\ 366 \\ 495 \\ \hline \end{array}$	$\begin{bmatrix} 1385 \\ 488 \\ 660 \end{bmatrix}$	$ 1730  \\  610  \\  825 $	$\begin{array}{ c c c }\hline 12075\\\hline 1732\\\hline 1990\\\hline\end{array}$	$     \begin{bmatrix}       2420 \\       \hline       854 \\       \hline       1155     \end{bmatrix} $	$ \begin{vmatrix} 2770 \\ 976 \\ 1320 \end{vmatrix} $	$\begin{vmatrix} 3110 \\ 1100 \\ 1485 \end{vmatrix}$
	6 7 8	$egin{array}{c c} 204 \\ 251 \\ 294 \\ \end{array}$	410   505   588	614   755   885	818  1005  1175	$ 1022 \\  1255 \\  1470$	1228  $ 1505 $ $ 1760 $	$   \begin{vmatrix}     1442 \\     1755 \\     2060   \end{vmatrix} $	$\begin{vmatrix} 1636 \\ 2010 \\ 2645 \end{vmatrix}$	$\begin{vmatrix} 1840 & 1 \\ 2260 & 1 \\ 2940 & 1 \end{vmatrix}$
42	$\begin{array}{ c c c }\hline & 9 \\\hline & 10 \\\hline & 4 \\\hline \end{array}$	$\begin{bmatrix} 336 \\ 382 \\ 132 \end{bmatrix}$	$egin{array}{c c} 672 \\ 764 \\ 264 \\ \end{array}$	1015  1145   396	$egin{array}{c}  1345 \\  1530 \\  528 \\ \end{array}$	$     \begin{bmatrix}       1680 \\       1910 \\       660     \end{bmatrix} $	$     \begin{bmatrix}     2015 \\     2290 \\     \hline     792     \end{bmatrix} $	$ \begin{vmatrix} 2350 \\ 2685 \\ 924 \end{vmatrix} $	$\begin{vmatrix} 2690 \\ 3060 \\ 1056 \end{vmatrix}$	3015  3440  1188
	$\begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$	$egin{array}{c c} 179 \\ 225 \\ 276 \\ \end{array}$	$egin{array}{c} 359 \\ 450 \\ 552 \\ \end{array}$	539   675   828	$egin{array}{c c} 718 \\ 900 \\ 1105 \\ \end{array}$	$egin{array}{c} 1897 \\ 11125 \\ 1380 \\ \end{array}$	$egin{array}{c}  1078 \\  1350 \\  1655 \\ \end{array}$	$     \begin{vmatrix}       1258 \\       1575 \\       1930     \end{vmatrix}   $	$     \begin{vmatrix}       1435 \\       1800 \\       2205     \end{vmatrix}   $	$\begin{vmatrix} 1615 \\ 2025 \\ 2480 \end{vmatrix}$
	$\frac{1}{1} - \frac{8}{9} - \frac{10}{10}$	$\begin{vmatrix} 320 \\ 365 \\ 417 \end{vmatrix}$	$egin{array}{c c} 640 \\ 730 \\ 834 \\ \end{array}$		1280  $ 1460 $ $ 1665 $	$   \begin{array}{c c}      1600 \\      1825 \\      2080 \\   \end{array} $	$ \begin{array}{c c}  1920 \\  2190 \\  2500 \end{array} $		$ \begin{vmatrix} 2560 \\ 2920 \\ 3330 \end{vmatrix} $	$\begin{vmatrix} 12880 & 1 \\ 3280 & 1 \\ 3750 &  \end{vmatrix}$
4 4	5 6 7	194   245   298	388   490   596	582   735   894	$egin{array}{c c} 776 \\ 980 \\ 1195 \\ \end{array}$	$\begin{array}{c c}   & 970 \\   1225 \end{array}$	$   \begin{vmatrix}     1165 \\     1470 \\     1785   \end{vmatrix} $	1360	$   \begin{array}{c}      1550 \\      1960 \\      2380   \end{array} $	$\begin{vmatrix} 1745 \\ 2205 \\ 2680 \end{vmatrix}$
	8 9 10	346 396 452	$egin{array}{c c} 692 \\ 792 \\ 904 \\ \end{array}$	1040  $ 1188 $ $ 1355 $	1385  1585  1805	1730 1980	$egin{array}{c}  2075 \\  2375 \\  2710 \\ \hline \end{array}$		$\begin{vmatrix} 2770 \\ 3170 \\ 3610 \end{vmatrix}$	$\begin{vmatrix} 3115 \\ 3560 \\ 4060 \end{vmatrix}$
46	$\begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$	209   264   323	$egin{array}{c c} 419 \\ 528 \\ 646 \\ \end{array}$	$\begin{bmatrix} 628 \\ 792 \\ 970 \end{bmatrix}$	$egin{array}{c c} 838 \\ 1055 \\ 1290 \\ \end{array}$	1048  1320	1258  1585  1935	11465	1675 12110 12580	1885 $2375$ $2905$
	$\begin{vmatrix} 8\\9\\10 \end{vmatrix}$	$\begin{vmatrix} 370 \\ 427 \\ 490 \end{vmatrix}$	740	11110	$\begin{vmatrix} 1280 \\ 1480 \\  1710 \\  1960 \end{vmatrix}$	$ \begin{bmatrix} 1850 \\ 2135 \end{bmatrix} $	$\begin{vmatrix} 12220 \\ 2560 \\ 2940 \end{vmatrix}$	2590  2990	$\begin{vmatrix} 12960 \\ 3420 \end{vmatrix}$	3330 3850 4410
48	6 7 8	282 348 400	564	846  1045	1128	11410 11740	1690  $ 2090 $	1975  $ 2435 $	$\begin{vmatrix} 3.720 \\ 2255 \\ 2785 \\ 3200 \end{vmatrix}$	$\begin{vmatrix} 2540 \\ 3130 \\ 3600 \end{vmatrix}$
	9	456			1825			3190	3650	4100

## MULTIPLE VOLUME TABLE—WESTERN WHITE PINE

			1	i	1		1			
DBH	Logs	1	$\lfloor 2 \rfloor$	3	4	5	6	7	8	9
= 0	10	526	1050	1580	2100	2630	3160	3680	4210	4740
50	6	320	640	960	1280	1600	1920	2240	2560	2880
	7	372	744	11115	1490	1860	2230	2600	2975	3350
	8	427	855	1280	1710	2140	2565	2990	3420	3850
	9	495	990	1485	1980	2470	2970	3460	3960	4450
- 2	10	562	1125	1685	2250	3810	3380	3940	4500	5060
52	$\frac{6}{5}$	326	652	978	1305	1630	1955	2280	2610	2925
	8	396	792	1190	1585	1980	2380	2775	3175	3560
	1	460	920	1380	1840	2300	2760	3220	3680	4140
	9	529	1060	1590	2120	2650	3180	3710	4240	4770
E 4	$\begin{array}{c c} 10 \\ 6 \end{array}$	606	1210	1820	2425	3030	3635	4240	4850	5450
54	9	350	700	1150	1400	1750	2100	2450	2800	3150
	6	423	846	1270	1695	2120	2540	2960	3390	3810
	8 9	497	994	1490	1985	2480	2980	3480	3970	4470
		570	1140	1710	2280	2850	3420	3990	4560	5130
56	$\begin{vmatrix} 10 \\ c \end{vmatrix}$	649	1298	1945	2600	3240	3890	4540	5190	5840
σο	$\frac{6}{7}$	373	746	1120	1490	1865	2240	2610	2985	3360
		450	900	1350	1800	2250	12700	3150	3600	4050
	8 9	527	1055	1580	2110	2640	3160	3690	4225	4750
	10	605	1210	1815	2420	3025	3630	4240	4840	5450
= 50		690	1380	2070	3760	3450	4140	4825	5525	6200
58	8 9	560	1120	1680	2240	2800	3360	3920	4480	5040
	$\begin{vmatrix} & 3 \\ 1 & 0 \end{vmatrix}$	$\begin{bmatrix} 639 \\ 729 \end{bmatrix}$	$ 1278 \\  1460$	1915	2550	3190	3830	4470	$\begin{bmatrix} 5100 \\ 5830 \end{bmatrix}$	$\begin{vmatrix} 5750 \\ 6560 \end{vmatrix}$
6.0			_1	2180	2910	3640	4370	5100		
60	8	592	1180	1770	2360	2960	3550	4140	4730	5325
	$\begin{vmatrix} & 9 \\ 10 \end{vmatrix}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	1345	2010	2690	3360	4030	4700	$\begin{vmatrix} 5375 \\ 6160 \end{vmatrix}$	$\begin{vmatrix} 6050 \\ 6940 \end{vmatrix}$
	10	170	1540	2310	3080	3850	4625	5400	10100	0340

## WESTERN YELLOW PINE

Bitterroot, Blackfeet, Kootenai, and Missoula National Forests, Montana.

Curved. Scribner Decimal C.

Diamete Breas High	st		Nun	nber of	16-Foot	Logs			Basis
Inches	1 1/4	2	3 Vo	lume—E	5   Board Fe	et. 6	7	8	Trees
8 9 10	2.0 2.5 3	3.5 4 4.5	5.5 6 7	10					$\begin{bmatrix} 7\\17\\30 \end{bmatrix}$
$\begin{bmatrix} 11\\12\\13 \end{bmatrix}$	$\begin{bmatrix} 3.5 \\ 4 \\ 4 \end{bmatrix}$	$\begin{bmatrix} 5 \\ 5.5 \\ 6 \end{bmatrix}$	8 9 10	$\begin{bmatrix} 12\\13\\14 \end{bmatrix}$	18				$ \begin{array}{c c} 88 \\ 163 \\ 201 \end{array} $
$\begin{bmatrix} 14\\15\\16 \end{bmatrix}$	4.5 5 6	$\begin{bmatrix} 7.0 \\ 8 \\ 9 \end{bmatrix}$	12 13 15	$\begin{bmatrix} 1 & 6 \\ 1 & 9 \\ 2 & 2 \end{bmatrix}$	$\begin{bmatrix} 23 \\ 26 \\ 29 \end{bmatrix}$	38			$   \begin{array}{c c}     202 \\     254 \\     221   \end{array} $
17 18 19		$\begin{bmatrix}10\\11\\12\end{bmatrix}$	$\begin{bmatrix} 17\\19\\21 \end{bmatrix}$	25 28 31	33 37 41	42 47 53			$ \begin{array}{c c} 230 \\ 211 \\ 184 \end{array} $
$\begin{bmatrix} 20\\21\\22 \end{bmatrix}$		14 15 17	23 26 29	35 38 43	46 52 57	$\begin{bmatrix} 59 \\ 65 \\ 72 \end{bmatrix}$	$\begin{bmatrix} 72\\79\\87 \end{bmatrix}$		$ \begin{array}{c c} 175 \\ 151 \\ 128 \end{array} $
$\begin{bmatrix} 23 \\ 24 \\ 25 \end{bmatrix}$		19	32 35 39	47 52 58	76	79 86 94	$\begin{array}{c c} 95\\ 104\\ 114 \end{array}$	$\begin{array}{c} 124 \\ 136 \end{array}$	94 88 79
26 27 28			43 48 53	64 70 78	84 92 101	$ \begin{array}{c c} 103 \\ 113 \\ 124 \end{array} $	$\begin{bmatrix} 125 \\ 137 \\ 149 \end{bmatrix}$	$148 \\ 161 \\ 174$	76 51 40
$\begin{bmatrix} 29\\30\\31 \end{bmatrix}$			59 65 72	$\begin{bmatrix} 85 \\ 93 \\ 102 \end{bmatrix}$	$egin{array}{c c} 110 &   \\ 121 &   \\ 132 &   \end{array}$	$\begin{bmatrix} 136 \\ 148 \\ 160 \end{bmatrix}$	$\begin{bmatrix} 162 \\ 175 \\ 188 \end{bmatrix}$	$   \begin{array}{r}     188 \\     203 \\     218   \end{array} $	$\begin{array}{ c c }\hline 26\\ 38\\ 15\\ \end{array}$
$\begin{bmatrix} 32 \\ 33 \\ 34 \end{bmatrix}$			80	$egin{array}{c c} 112 \\ 122 \\ 133 \\ \end{array}$	$   \begin{array}{c c}     143 \\     154 \\     165   \end{array} $	$   \begin{array}{c c}     172 \\     185 \\     198   \end{array} $	$\begin{bmatrix} 201 \\ 216 \\ 230 \end{bmatrix}$	$234 \\ 250 \\ 266$	15 13 5
35 36 37				145 157 170	$ \begin{array}{c c} 177 \\ 189 \\ 201 \end{array} $	$\begin{bmatrix} 211 \\ 224 \\ 238 \end{bmatrix}$	$\begin{bmatrix} 245 \\ 260 \\ 275 \end{bmatrix}$	282 298 314	8 3 1
38 39 40				$ \begin{array}{c c} 183 \\ 196 \\ 210 \end{array} $	$egin{array}{c c} 214 &   \\ 227 &   \\ 241 &   \\ \end{array}$	$\begin{bmatrix} 252 \\ 266 \\ 280 \end{bmatrix}$	$\begin{bmatrix} 290 \\ 306 \\ 322 \end{bmatrix}$	$   \begin{array}{r}     330 \\     346 \\     362   \end{array} $	1 3
İ					i	i	1		2822

Top diameter inside bark 6 inches throughout.

Stump height one foot.

Scaled from taper curves, mostly in 16.3 foot logs, with a few shorter logs where necessary.

## MULTIPLE VOLUME TABLE—LARCH

(Constructed by the Frustum Form Factor method. Based on 233 trees.)
Scribner Decimal C Rule.

DBH	Logs	1	2	3	4	5	6	7	8	9
8	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c c} 2.5 \\ 4.5 \\ 7 \end{array} $	$oxed{4.5} \ 8.5 \ 13.5$	$egin{array}{c c} \hline 7 \ \hline 13 \ 20 \end{array}$	$\begin{vmatrix} 9.5\\17\\27\end{vmatrix}$	$egin{array}{c c} 11.5 \\ 21.5 \\ 34 \\ \end{array}$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c c} 16.5 \\ 30 \\ 47 \end{array} $	19 34.5	$egin{array}{ c c c c c c c c c c c c c c c c c c c$
10	$\begin{bmatrix} 3 \\ 4 \\ 1 \\ 2 \end{bmatrix}$	$ \begin{array}{c c} 9.5 \\ 2.5 \\ 4.5 \end{array} $	$ \begin{array}{ c c c c } \hline 18.5 \\ 5 \\ 9.5 \\ \end{array} $	$egin{bmatrix} -20 \ 28 \ 7.5 \ 14 \end{bmatrix}$	$\begin{bmatrix} -\frac{27}{37} \\ 10 \\ 19 \end{bmatrix}$	$egin{array}{c c} 34 \\ 46.5 \\ 12 \\ 23.5 \\ \end{array}$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$egin{array}{c c} 47 \\ 65 \\ 17 \\ 33 \\ \end{array}$	$ \begin{array}{ c c c c } \hline  54 \\  74.5 \\  19.5 \\  37.5 \\ \hline \end{array} $	$ \begin{array}{ c c c c } \hline  & 61 \\  & 84 \\  & 22 \\  & 42.5 \\ \end{array} $
12	3 4 1	$\begin{array}{ c c }\hline & 8\\ & 11\\ & 2.5\\ \hline \end{array}$	$\begin{array}{ c c c }\hline & 16 \\ & 22 \\ & 5 \\ \hline \end{array}$	24 33 8	$egin{array}{c c} 32 \\ 44.5 \\ 10.5 \\ \end{array}$	40 55.5 13	$\begin{array}{ c c c }\hline & 48 \\ & 66.5 \\ & 15.5 \\ \hline \end{array}$	$   \begin{array}{c c}     56 \\     77.5 \\     18   \end{array} $	$\begin{bmatrix} 64 \\ 89 \\ 21 \end{bmatrix}$	$begin{pmatrix} 12.5 \\ 72 \\ 100 \\ 23.5 \\ \hline \end{bmatrix}$
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	5.5 $9.5$ $13.5$	11 19 26	$   \begin{array}{r}     16.5 \\     28 \\     41   \end{array} $	$ \begin{array}{c c} 22 \\ 37.5 \\ 54.5 \end{array} $	27 47 68	$   \begin{array}{r}     32.5 \\     56.5 \\     81.5   \end{array} $	38 66 95	$ \begin{array}{r} 43.5 \\ 75 \\ 109 \end{array} $	$ \begin{array}{c c} 49 \\ 84.5 \\ 122.5 \end{array} $
14	$egin{array}{c} 5 \ 6 \ 1 \end{array}$	18 22 3	$\begin{array}{c} 36\\44\\5.5\end{array}$	$53.5 \\ 65.5 \\ 8.5$	71.5 87.5 11	$ \begin{array}{c c} 89 \\ 109.5 \\ 14 \end{array} $	$egin{array}{c c} 107 \\ 131.5 \\ 16.5 \\ \end{array}$	$125 \\ 153.5 \\ 19.5$	$\begin{array}{ c c c }\hline 143 \\ 175.5 \\ 22.5 \\ \end{array}$	$begin{array}{c c} 161 \\ 197.5 \\ 25 \\ \hline \end{array}$
	$\begin{bmatrix} 2\\ 3\\ 4 \end{bmatrix}$	$\begin{array}{c} 6.5 \\ 12 \\ 17 \end{array}$	$ \begin{array}{c c} 13 \\ 23.5 \\ 33.5 \end{array} $	$ \begin{array}{r r}  & 19 \\  & 35.5 \\  & 50.5 \end{array} $	$egin{array}{c c} 25.5 \\ 47.5 \\ 67 \\ \end{array}$	32 59 84	$\begin{vmatrix} 38.5 \\ 71 \\ 101 \end{vmatrix}$	45 83 118	$egin{array}{c} 51 \\ 95 \\ 134.5 \\ \end{array}$	$egin{array}{c c} 57.5 \\ 107 \\ 151 \\ \end{array}$
	5 6 7	22.5 28 33	$\begin{array}{c c} 45 \\ 55.5 \\ 66 \end{array}$	57 83.5 99	$   \begin{array}{r}     89.5 \\     111 \\     132   \end{array} $	$egin{array}{c} 112 \\ 139 \\ 165 \\ \end{array}$	$\begin{array}{c} 134.5 \\ 166.5 \\ 198 \end{array}$	$157 \\ 195 \\ 231$	$egin{array}{c} 179 \ 222 \ 264 \ \hline \end{array}$	$egin{array}{c} 202 \\ 250 \\ 297 \\ \end{array}$
16	$\begin{bmatrix} 8 \\ 1 \\ 2 \end{bmatrix}$	38.5 3 8	$77 \\ 6.5 \\ 15.5$	$egin{array}{c} 115 \\ 9.5 \\ 23.5 \\ \end{array}$	$egin{array}{c} 153.5 \\ 13 \\ 31 \\ \end{array}$	$egin{array}{c} 192 \\ 16 \\ 39 \\ \end{array}$	$\begin{bmatrix} 230 \\ 19 \\ 47 \end{bmatrix}$	$   \begin{array}{r}     269 \\     22.5 \\     54.5   \end{array} $	$egin{array}{c} 307 \\ 25.5 \\ 62.5 \\ \end{array}$	$\begin{bmatrix} 346 \\ 29 \\ 70 \end{bmatrix}$
	3 4 5	$egin{array}{c} 14.5 \ 21 \ 27.5 \end{array}$	2 9 4 2 5 5	$\begin{bmatrix} 43 \\ 63 \\ 82.5 \end{bmatrix}$	57.5 84 110	$egin{array}{c} 72 \\ 105 \\ 137.5 \\ \end{array}$	$   \begin{array}{r}     86.5 \\     126 \\     165   \end{array} $	$101 \\ 147 \\ 192$	$egin{array}{c} 115 \\ 168 \\ 220 \\ \end{array}$	$begin{bmatrix} 129.5 \\ 189 \\ 247 \\ \hline \end{bmatrix}$
	6 7 8	35 42 49	$   \begin{array}{r}     69.5 \\     84 \\     97.5   \end{array} $	$egin{array}{c} 104.5 \ 125.5 \ 146 \ \end{array}$	$   \begin{array}{c c}     139 \\     167.5 \\     195   \end{array} $	$egin{array}{c} 174 \\ 209 \\ 243 \\ \end{array}$	$egin{array}{c} 209 \ 251 \ 292 \ \hline \end{array}$	$   \begin{array}{c}     244 \\     293 \\     341   \end{array} $	$egin{array}{c} 278 \\ 335 \\ 390 \\ \hline \end{array}$	$\begin{bmatrix} 313 \\ 376 \\ 438 \end{bmatrix}$
18	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{array}{c} 3.5 \\ 9 \\ 17 \end{array}$	7 18 34	$egin{array}{c} 10.5 \\ 27 \\ 51 \\ \end{array}$	14 36 68	17.5 45 85	$\begin{array}{c} 21 \\ 54 \\ 101 \end{array}$	$   \begin{array}{r}     24.5 \\     63 \\     118   \end{array} $	$\begin{array}{c} 28 \\ 72 \\ 135 \end{array}$	$ \begin{array}{c c} 31.5 \\ 81 \\ 152 \end{array} $
	5 6	26 34 42	52 68 84	78 102 126	104 136 168	$     \begin{array}{c c}       130 \\       170 \\       210 \\    \end{array} $	$156 \\ 204 \\ 252$	182 238 294	208 272 336	234 306 378
	8 9	51 60 68.5	$\begin{array}{c} 102 \\ 120 \\ 136.5 \end{array}$	$\begin{array}{c} 180 \\ 205 \end{array}$	204 240 273	$   \begin{array}{c c}     256 \\     300 \\     342   \end{array} $	$\begin{array}{c} 360 \\ 410 \end{array}$	358 420 478	410 480 546	460 540 615
20	$\begin{bmatrix} 10 \\ 1 \\ 2 \end{bmatrix}$	$   \begin{array}{r}     77 \\     3.5 \\     10   \end{array} $	$ \begin{array}{c c} 153.5 \\ 7.5 \\ 20.5 \end{array} $	$egin{array}{c} 230 \\ 11 \\ 31 \\ \hline \end{array}$	$\begin{vmatrix} 307 \\ 15 \\ 41 \end{vmatrix}$	384 19 51	$ \begin{array}{c c} 460 \\ 22.5 \\ 61.5 \end{array} $	538 26 72	$ \begin{array}{r} 615 \\ 30 \\ 82 \\ \hline \end{array} $	$\begin{bmatrix} 690 \\ 34 \\ 92 \end{bmatrix}$
	3 4 5	$ \begin{array}{c} 20 \\ 29.5 \\ 39.5 \end{array} $	$ \begin{array}{c c} 40.5 \\ 59 \\ 79 \\ \end{array} $	$\begin{array}{c c} 60.5 \\ 89 \\ 119 \\ \hline \end{array}$	81 118 158	101 148 198	$   \begin{array}{c}     121 \\     177.5 \\     238   \end{array} $	$   \begin{array}{c}     141.5 \\     207 \\     277 \\     \hline     \end{array} $	$   \begin{array}{r}     161.5 \\     236 \\     317 \\   \end{array} $	182 266 356
	6 7 8	50 59 70	$   \begin{array}{c}     100 \\     118 \\     140   \end{array} $	$egin{array}{c} 150 \\ 177.5 \\ 210 \\ \end{array}$	$   \begin{array}{c}     200 \\     236 \\     280   \end{array} $	$   \begin{array}{r}     250 \\     296 \\     350   \end{array} $	$   \begin{array}{r}     300 \\     355 \\     420   \end{array} $	350 414 490	$egin{array}{c} 400 \\ 473 \\ 560 \\ \hline \end{array}$	$egin{array}{c} 450 \\ 532 \\ 630 \\ \end{array}$

## MULTIPLE VOLUME TABLE—LARCH

DBH	_   Logs	1	2	3	4	5	6	7	8	9
22	$\begin{bmatrix} 9\\10\\1 \end{bmatrix}$	80 90 4	160 180 8	$egin{array}{c} 240 \ 270 \ 12 \ \end{array}$	$oxed{320}{360}{16}$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{vmatrix} 480 \\ 540 \\ 23 \end{vmatrix}$	$\begin{vmatrix} 560 \\ 630 \\ 27 \end{vmatrix}$	$ \begin{vmatrix} 640 \\ 720 \\ 31 \end{vmatrix} $	$   \begin{array}{ c c c c c c c c c c c c c c c c c c c$
22	$\frac{2}{3}$	$\begin{array}{c} 11 \\ 23 \end{array}$	22	3 4 68	45 91	57	68	79 160	$\begin{array}{c} 91 \\ 182 \end{array}$	102 205
	4   5   6	$\begin{array}{ c c c }\hline 34\\\hline 46\\\hline 57\\\hline \end{array}$	$     \begin{array}{r r}                                    $	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c } \hline  & 136 \\ \hline  & 184 \\ \hline  & 230 \\ \end{array} $	$ \begin{array}{ c c } \hline 170 \\ 229 \\ 288 \end{array} $	$     \begin{array}{r r}                                    $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{r r} & 272 \\ \hline & 367 \\ & 462 \end{array}$	$\begin{array}{r r} & 306 \\ \hline & 413 \\ & 518 \end{array}$
	$\begin{vmatrix} 7 \\ 8 \\ 9 \end{vmatrix}$	$ \begin{array}{ c c c } \hline 70 \\ 81 \\ 93 \\ \end{array} $	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r r}  & 280 \\ \hline  & 324 \\ \hline  & 374 \\ \end{array} $	350   405   468	$  \begin{array}{c c} 420 \\ \hline 486 \\ 562 \\   \end{array}$	$     \begin{array}{r r}                                    $	$\begin{array}{ c c c }\hline & 560 \\ \hline & 650 \\ \hline & 750 \\ \hline \end{array}$	$\begin{array}{r r} & 630 \\ \hline & 730 \\ & 842 \end{array}$
$\frac{1}{24}$	$\begin{array}{ c c }\hline 10\\\hline 2\\3\\\hline \end{array}$	$\begin{array}{ c c c }\hline 105\\\hline 14\\26\\\hline\end{array}$	$\begin{array}{ c c c }\hline 210\\\hline &27\\\hline &53\\\hline \end{array}$	315 41 80	420   55   106	$\begin{array}{ c c c }\hline & 524 \\ \hline & 69 \\ \hline & 133 \\ \end{array}$	$\begin{array}{r r} & 630 \\ \hline & 82 \\ \hline & 159 \end{array}$	$\begin{array}{ c c }\hline 735\\ \hline 96\\ 186\\ \end{array}$	$\begin{array}{ c c c c c c }\hline & 840 \\ \hline & 110 \\ & 213 \\ \hline \end{array}$	$\begin{array}{ c c c c }\hline & 944 \\ \hline & 124 \\ & 239 \\ \hline \end{array}$
	5	40 54	$\begin{array}{ c c c c }\hline 81\\\hline 109\\ \end{array}$	121 163	$\begin{array}{r r} 162 \\ \hline 218 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	382	$\begin{array}{r r} 323 \\ \hline 436 \end{array}$	$\begin{array}{r r} 364 \\ \hline 490 \end{array}$
	$\begin{array}{c c} & 6 \\ \hline 7 \\ \hline \\ 8 \end{array}$	$\begin{array}{ c c } \hline 68 \\ 81 \\ \hline 96 \\ \end{array}$	$     \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c }\hline 205 \\ 245 \\ \hline 290 \\ \end{array}$	$\begin{array}{ c c }\hline 274\\ 326\\\hline \hline 386\\ \end{array}$	342   408   483	$\begin{array}{r r} 410 \\ 490 \\ \hline \hline 1580 \end{array}$	$     \begin{array}{r r}                                    $	$\begin{array}{ c c c }\hline 548 \\ 683 \\ \hline \hline 773 \\ \hline \end{array}$	$\begin{array}{r r} & 616 \\ \hline & 735 \\ \hline & 870 \end{array}$
26	$\begin{array}{c c} & 9 \\ 10 \\ \hline & 2 \end{array}$	$\begin{array}{r r} 110 \\ 124 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 220 \\ 249 \\ \hline \hline 30 \\ \end{array}$	$\begin{vmatrix} 330 \\ 374 \\ 45 \end{vmatrix}$	$\begin{array}{ c c c c c }\hline & 440 \\ & 498 \\ \hline & 60 \\ \hline \end{array}$	$\begin{array}{r r} 550 \\ 623 \\ \hline 75 \end{array}$	$\begin{array}{r r} & 660 \\ \hline & 748 \\ \hline \hline & 90 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$     \begin{array}{r r}                                    $	$ \begin{array}{r}  990 \\  1120 \\ \hline  135 \end{array} $
20	3 4	3 4 4 6	78 93	$\begin{array}{ c c c }\hline 102 \\ 139 \\ \end{array}$	136   185	$\begin{array}{ c c c }\hline 170 \\ 232 \end{array}$	204 278	238 324	272 371	306
	5 6 7	$\begin{bmatrix} 62\\79\\95 \end{bmatrix}$	$ \begin{array}{c} 124 \\ 158 \\ 191 \\  \end{array}$	$egin{array}{c} 186 \\ 237 \\ 287 \\ \end{array}$	248   316   382	310   395   478	372 474 574	434   553   670	$\begin{vmatrix} 495 \\ 630 \\ 765 \end{vmatrix}$	558 710 860
	$\begin{bmatrix} 8\\9\\10 \end{bmatrix}$	$   \begin{array}{c}     111 \\     127 \\     143   \end{array} $	$egin{array}{c} 222 \\ 254 \\ 286 \\ \end{array}$	333 381 430	$oxed{444} 508 573$	$oxed{555} \ 635 \ 715$	$oxed{ 666 \ 762 \ 860 }$	777   890   1000	$\begin{vmatrix} 888 \\ 1015 \\ 1145 \end{vmatrix}$	$egin{array}{c} 999 \ 1140 \ 1290 \ \end{array}$
28	2 3 4	17 35 53	$\begin{bmatrix} 34 \\ 70 \\ 106 \end{bmatrix}$	$   \begin{array}{r}     51 \\     105 \\     159   \end{array} $	$\begin{vmatrix} 68 \\ 140 \\ 212 \end{vmatrix}$	$egin{array}{c c} 85 \\ 175 \\ 265 \\ \end{array}$	$egin{array}{c c} 102 \\ 210 \\ 318 \\ \end{array}$	$egin{array}{c c} 119 \\ 245 \\ 371 \\ \end{array}$	$ \begin{array}{ c c c c c } \hline 136 \\ 280 \\ 424 \\ \end{array} $	153 315 477
	5 6 7	$\begin{bmatrix} 71\\90\\109 \end{bmatrix}$	143 180 218	$egin{array}{c} 214 \\ 270 \\ 327 \\ \end{array}$	286   360   436	357 450 545	430   540   654	500   630   763	572 720 872	644   810   981
	8 9 10	$egin{array}{c} 128 \\ 147 \\ 165 \\ \end{array}$	$oxed{257} \ 294 \ 330$	385 440 495	$ \begin{array}{c c} 513 \\ 590 \\ 660 \\  \end{array}$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	770 883 990	$     \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r r}     \hline                                $	$ \begin{array}{c c}  & 355 \\  & 1355 \\  & 1325 \\  & 1485 \end{array} $
5.0	3 4	39 60	$\begin{array}{ c c c }\hline 78 \\ 120 \\ \end{array}$	117 180	157	196	235   360	274   420	314	353 540
	$\begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$	$\begin{array}{ c c c }\hline 83\\\hline 103\\\hline 126\\\hline \end{array}$	$\begin{array}{ c c c }\hline & 166 \\ \hline & 206 \\ & 252 \\ \hline \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	332   413   504	415   516   630	$\begin{array}{r r}   & 500 \\ \hline   & 620 \\ \hline   & 755 \\ \end{array}$	580   723   880	$ \begin{array}{r r}  & 664 \\ \hline  & 825 \\  & 1010 \\ \end{array} $	$ \begin{array}{r r}     746 \\     930 \\     1135 \end{array} $
	$\begin{bmatrix} 8\\9\\10 \end{bmatrix}$	$egin{array}{c} 147 \\ 168 \\ 189 \\ \end{array}$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$egin{array}{c c} 440 \\ 504 \\ 567 \\ \hline \end{array}$	587   682   756	735   840   945	$\begin{vmatrix} 880 \\  1010 \\  1135 \end{vmatrix}$	$     \begin{vmatrix}       1030 \\       \hline       1175 \\       \hline       1320     $	$     \begin{array}{r}                                     $	$\begin{array}{r}  1320 \\ \hline  1510 \\  1700 \\ \end{array}$
32	3   4   5	$\begin{array}{ c c }\hline 44\\ \hline 67\\ \hline 91\\ \end{array}$	$\begin{array}{ c c c }\hline 88\\\hline 135\\\hline 183\\ \end{array}$	$\begin{array}{ c c c c c }\hline & 132 \\ \hline & 203 \\ & 274 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 176 \\ \hline 270 \\ 366 \end{array}$	220   338   457	$ \begin{array}{c c}  & 264 \\ \hline  & 405 \\  & 550 \end{array} $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{r r} 352 \\ \hline 540 \\ \hline 733 \end{array}$	$\frac{1396}{608}$
	$\begin{vmatrix} 6 \\ 7 \end{vmatrix}$	$\begin{array}{ c c c c }\hline 115 \\ \hline 138 \\ \hline \end{array}$	$\begin{bmatrix} 230 \\ 276 \end{bmatrix}$	345	$\frac{ 460}{ 550}$	$\begin{bmatrix} 575 \\ 690 \end{bmatrix}$	$\frac{ .690 }{ .830 }$	$\begin{array}{r r} 805 \\ \hline 1965 \end{array}$	$\begin{array}{ c c c c c }\hline 920\\\hline 1105\\ \end{array}$	$\frac{ 1035 }{ 1240 }$
	8 9	161	$\begin{array}{ c c c }\hline 322\\372\\ \end{array}$	484   558	645   744	805	$\begin{array}{r r} 967 \\ \hline 1115 \end{array}$	1130	$\begin{vmatrix} 1290 \\ 1490 \end{vmatrix}$	$\begin{vmatrix} 1450 \\ 1675 \end{vmatrix}$

## MULTIPLE VOLUME TABLE-LARCH

DBH	Logs	1	2	3	4	5	6	7	8	9
34	10 4 5	$\begin{bmatrix} 209 \\ 74 \\ 98 \end{bmatrix}$	418 149 196	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{vmatrix} 835 \\ 298 \\ 392 \end{vmatrix}$	$\begin{vmatrix} 1045 \\ 372 \\ 490 \end{vmatrix}$	$\begin{vmatrix} 1250 \\ 446 \\ 590 \end{vmatrix}$	$egin{pmatrix} 14\overline{60} \\ 520 \\ 686 \\ \end{bmatrix}$	$\begin{vmatrix} 1670 \\ 596 \\ 785 \end{vmatrix}$	$\begin{vmatrix} 1880 \\ 670 \\ 883 \end{vmatrix}$
	678	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	248 298 352	$\begin{vmatrix} 372 \\ 446 \\ 528 \end{vmatrix}$	$\begin{vmatrix} 496 \\ 595 \\ 705 \end{vmatrix}$	$ \begin{array}{ c c c } \hline 620 \\ 745 \\ 880 \end{array} $	$     \begin{array}{r r}       745 \\       895 \\       1060     \end{array} $	$ \begin{array}{ c c c c c c } \hline 870 \\ 1045 \\ 1230 \\ \hline \end{array} $	$\begin{vmatrix} 990 \\ 1190 \\ 1410 \end{vmatrix}$	$\begin{vmatrix} 1115 \\ 1340 \\ 1585 \end{vmatrix}$
36	10 5	$oxed{ egin{array}{c} 202 \ 227 \ 107 \ \end{array} }$	$\begin{vmatrix} 404 \\ 454 \\ 214 \end{vmatrix}$	$\begin{vmatrix} 605 \\ 682 \\ 321 \end{vmatrix}$	806 910 428	$\begin{vmatrix} 1010 \\ 1135 \\ 535 \end{vmatrix}$	$\begin{vmatrix} 1210 \\ 1360 \\ 642 \end{vmatrix}$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{vmatrix} 1610 \\ 1820 \\ 856 \end{vmatrix}$	$\begin{vmatrix} 1815 \\ 2040 \\ 963 \end{vmatrix}$
	678	$egin{array}{c c} 137 \\ 165 \\ 191 \\ \end{array}$	$egin{array}{c} 274 \\ 330 \\ 382 \\ \end{array}$	$\begin{vmatrix} 410 \\ 495 \\ 574 \end{vmatrix}$	$\begin{vmatrix} 548 \\ 660 \\ 765 \end{vmatrix}$	675   825   955	$oxed{823} \ 990 \ 1150$	$   \begin{array}{ c c c c c c c c c c c c c c c c c c c$		$   \begin{vmatrix}     1370 \\     1480 \\     1720   \end{vmatrix} $
38	$10 \frac{9}{5}$	$egin{array}{c} 220 \\ 248 \\ 117 \\ \end{array}$	$egin{array}{c c} 440 \\ 497 \\ 234 \\ \end{array}$	$     \begin{array}{r}       660 \\       745 \\       350     \end{array} $	880   994   467	$\begin{vmatrix} 1100 \\ 1240 \\ 584 \end{vmatrix}$	$\begin{vmatrix} 1320 \\ 1490 \\ 700 \end{vmatrix}$	$\begin{vmatrix} 1540 \\ 1740 \\ 818 \end{vmatrix}$	$\begin{vmatrix} 1760 \\ 1985 \\ 935 \end{vmatrix}$	$ \begin{array}{ c c c c c } \hline  1980 \\  2480 \\  1050 \\ \hline \end{array} $
0.0	$\frac{6}{7}$	$ \begin{array}{ c c c c } \hline 146 \\ 175 \\ 203 \\ \end{array} $	$egin{array}{c c} 293 \\ 350 \\ 406 \\ \end{array}$	$oxed{440} 525 610$	$\begin{vmatrix} 585 \\ 700 \\ 810 \end{vmatrix}$	$\begin{vmatrix} 733\\875\\1015 \end{vmatrix}$	$   \begin{vmatrix}     880 \\     1050 \\     1220   \end{vmatrix} $	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{r}  1170 \\  1400 \\  1625 \end{array} $	$\begin{vmatrix} 1320 \\ 1575 \\ 1830 \end{vmatrix}$
40	$10 \frac{9}{5}$	$egin{array}{c c} 238 \\ 267 \\ 126 \\ \end{array}$	$egin{array}{c c} 476 \\ 535 \\ 252 \\ \hline \end{array}$	714 800 378	$\begin{vmatrix} 310 \\ 955 \\ 1065 \\ 504 \end{vmatrix}$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c }\hline 1430 \\ 1600 \\ 756 \end{array} $	$   \begin{array}{ c c c c }     \hline 1665 \\     \hline 1870 \\     \hline 882 \\   \end{array} $	$\begin{vmatrix} 1929 \\ 1900 \\ 2140 \\ 1010 \end{vmatrix}$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$
- +0	$\frac{6}{7}$	$\begin{bmatrix} 157 \\ 192 \end{bmatrix}$	314 384	470 575	628	785	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{vmatrix} 1100 \\ 1345 \end{vmatrix}$	$\begin{array}{ c c c }\hline 1250 \\ 1540\end{array}$	$\begin{bmatrix} 1410 \\ 1730 \end{bmatrix}$
	8 9 10	$egin{array}{c c} 225 \\ 257 \\ 292 \\ \end{array}$	450   514   584	$oxed{675} \ 770 \ 875$	$rac{ \ 900}{ \ 1030} - $	$egin{array}{c}  1125 \\  1285 \\  1460 \\ \end{array}$	$ \begin{array}{r}  1350 \\  1540 \\  1750 \\ \end{array} $	$\begin{vmatrix} 1575 \\ 1800 \\ 2040 \end{vmatrix}$	$\frac{ 1800 }{ 2060 } = \\  2340 $	$\begin{array}{ c c c c c c }\hline  2020 \\  2310 \\  2630 \\ \end{array}$

## MULTIPLE VOLUME TABLE-DOUGLAS FIR

(Constructed by the Frustum Form Factor method.) Scribner Decimal C Rule.

Number of Trees.

DBH	Logs	1	2	3	-1	5	6	7	8	9
8	$\frac{1}{2}$	2.5 4.5 7.0	$   \begin{array}{c}     5 \\     8.5 \\     13.5   \end{array} $	$\begin{array}{c c} 7 \\ 13 \\ 20.5 \end{array}$	$ \begin{array}{r r} 9.5 \\ 17.5 \\ 27.5 \end{array} $	$\begin{array}{ c c c }\hline 12\\22\\34\\ \end{array}$	$ \begin{array}{c c}  & 14.5 \\  & 26 \\  & 41 \end{array} $	$\begin{array}{c} 17\\30.5\\48\end{array}$	19 35 55	$\begin{bmatrix} 21.5 \\ 39 \\ 61.5 \end{bmatrix}$
10	$\frac{1}{2}$	2.5 4.5 8.0	$\begin{smallmatrix} -&5\\9.5\\16\end{smallmatrix}$	$\begin{array}{c} 7.5 \\ 14 \\ 24 \end{array}$	$\begin{bmatrix} 10 \\ 19 \\ 32 \end{bmatrix}$	$\begin{bmatrix} 12\\24\\40 \end{bmatrix}$	$ \begin{array}{c c} 14.5 \\ 28.5 \\ 48 \end{array} $	$\begin{array}{c} 17\\33\\56.5\end{array}$	$egin{array}{c c} 19.5 \\ 38 \\ 64.5 \\ \end{array}$	$\begin{bmatrix} 22 \\ 43 \\ 72.5 \end{bmatrix}$
12	$egin{array}{c} 4 \\ 1 \\ 2 \end{array}$	$ \begin{array}{c c} 11.0 \\ 2.5 \\ 5.5 \end{array} $	$ \begin{array}{c} 22.5 \\ 5.5 \\ 11 \end{array} $	$\begin{array}{c} 33.5 \\ 8 \\ 16.5 \end{array}$	$\begin{array}{ c c }\hline 45\\10.5\\22\end{array}$	$\begin{bmatrix} 56\\13\\27.5\end{bmatrix}$	$\begin{bmatrix} 67\\16\\33 \end{bmatrix}$	$78.5 \\ 18.5 \\ 38.5$	$\begin{bmatrix} 89.5 \\ 21 \\ 44 \end{bmatrix}$	$ \begin{array}{c c} 101 &   \\ 24 &   \\ 49.5 &   \end{array}$
	3 4 5	$9.5 \\ 14.0 \\ 18.0$	$   \begin{array}{c}     19 \\     27.5 \\     36   \end{array} $	$28.5 \\ 41.5 \\ 54$	38 45 72	$\begin{array}{c c} 47.5 \\ 69 \\ 90.5 \end{array}$	57 83 108	$66.5 \\ 96.5 \\ 126$	$ \begin{array}{c c} 76 \\ 110.5 \\ 144 \end{array} $	$\left \begin{array}{c}85.5\\124\\162\end{array}\right $
14	$egin{pmatrix} 6 \ 1 \ 2 \end{bmatrix}$	$egin{array}{c} 22.0 \ 3.0 \ 6.5 \ \end{array}$	$\begin{array}{c} 44\\5.5\\13\end{array}$	$66.5 \\ 8.5 \\ 19$	$ \begin{array}{c c} 88.5 \\ 11 \\ 25.5 \end{array} $	$egin{bmatrix} 111 \ 14 \ 32 \ \end{bmatrix}$	$\begin{vmatrix} 133 \\ 17 \\ 38.5 \end{vmatrix}$	$155 \\ 19.5 \\ 45$	$egin{array}{c} 177 \\ 22.5 \\ 51 \\ \end{array}$	$\left  \begin{array}{c} 199 \\ 25 \\ 57.5 \end{array} \right $
	3 4 5	$egin{array}{c c} 12.0 \\ 17.0 \\ 22.5 \\ \end{array}$	$ \begin{array}{c c} 23.5 \\ 33.5 \\ 45 \end{array} $	$ \begin{array}{c c} 35.5 \\ 50.5 \\ 67.5 \end{array} $	$egin{array}{c} 47.5 \\ 67 \\ 89.5 \\ \end{array}$	$egin{array}{c} 59.5 \\ 84 \\ 112 \\ \hline \end{array}$	$\begin{bmatrix} 71 \\ 101 \\ 134.5 \end{bmatrix}$	$   \begin{array}{c}     83 \\     117.5 \\     157   \end{array} $	$\begin{array}{c c} 95 \\ 134.5 \\ 179 \end{array}$	$begin{bmatrix} 107 \\ 151 \\ 202 \\ \end{bmatrix}$
16	$\begin{bmatrix} 6 \\ 1 \\ 2 \end{bmatrix}$	$ \begin{array}{c c} 28.0 \\ 3.0 \\ 8.0 \end{array} $	$55.5 \\ 6 \\ 15.5$	$83.5 \\ 9.5 \\ 23.5$	$egin{array}{c} 111 \\ 12.5 \\ 31 \\ \end{array}$	$\begin{bmatrix} 139 \\ 16 \\ 39 \end{bmatrix}$	$egin{array}{c c} 166.5 \\ 19 \\ 47 \\ \end{array}$	$194.5 \\ 22.5 \\ 54.5$	$\begin{array}{c c} 222 \\ 25.5 \\ 62.5 \end{array}$	$\begin{bmatrix} 250 \\ 29 \\ 70 \end{bmatrix}$
	3 4 5	$\begin{array}{ c c c }\hline 14.5 \\ 21.0 \\ 27.5 \\ \hline \end{array}$	29 42 55	$\begin{array}{c c} 43 \\ 63 \\ 82.5 \end{array}$	$\begin{bmatrix} 57.5 \\ 84 \\ 110 \end{bmatrix}$	$egin{array}{c c} 72 \\ 105 \\ 137.5 \\ \end{array}$	$\left \begin{array}{c}86.5\\126\\165\end{array}\right $	$ \begin{array}{c c} 101 \\ 147 \\ 192.5 \end{array} $	$egin{array}{c} 115 \\ 168 \\ 220 \\ \end{array}$	144 189 248
	$\begin{bmatrix} 6\\7\\8\\1 \end{bmatrix}$	$\begin{bmatrix} 35.0 \\ 42.0 \\ 48.5 \end{bmatrix}$	$   \begin{array}{c c}     70 \\     84 \\     97.5   \end{array} $	$egin{array}{c} 105 \\ 125.5 \\ 146 \\ \end{array}$	$\begin{array}{ c c c }\hline & 139.5 \\ 167.5 \\ & 194.5 \\ \hline \end{array}$	$ \begin{array}{c} 174.5 \\ 209 \\ 243 \end{array} $	$egin{array}{c} 210 \ 251 \ 292 \end{array}$	$   \begin{array}{c}     244 \\     293 \\     340   \end{array} $	$\begin{vmatrix} 280 \\ 335 \\ 389 \end{vmatrix}$	314 378 438
18	$\begin{bmatrix} 2 \\ 3 \end{bmatrix}$	$\begin{array}{c c} 3.5 \\ 9.0 \\ 17.0 \end{array}$	$\begin{array}{c} 7 \\ 18 \\ 34 \end{array}$	$egin{array}{c} 10.5 \\ 36 \\ 51 \\ \end{array}$	$egin{array}{c} 14 \\ 45 \\ 67.5 \\ \end{array}$	$egin{array}{c c} 17.5 \\ 54 \\ 84.5 \\ \end{array}$	$\begin{bmatrix} 21\\63\\101.5\end{bmatrix}$	$   \begin{array}{c}     24.5 \\     72 \\     118   \end{array} $	$\begin{vmatrix} 28\\81\\135 \end{vmatrix}$	$\begin{bmatrix} 31.5 \\ 99 \\ 152 \end{bmatrix}$
	4 5 6	$ \begin{array}{c c} 26.0 \\ 34.0 \\ 42 \end{array} $	52 68 84	$\begin{bmatrix} 65\\102\\126 \end{bmatrix}$	78 136 168	$egin{array}{c} 104 \\ 170.5 \\ 210 \\ \end{array}$	$egin{array}{c} 130 \\ 204.5 \\ 252 \\ \end{array}$	$156 \\ 239 \\ 294$	$     \begin{array}{c c}       182 \\       273 \\       336     \end{array} $	$\begin{bmatrix} 208 \\ 307 \\ 378 \end{bmatrix}$
20	8 1	$\begin{bmatrix} 51 \\ 60 \\ 4 \end{bmatrix}$	$\begin{bmatrix} 102 \\ 120 \\ 7.5 \end{bmatrix}$	$egin{array}{c} 153 \\ 179.5 \\ 11.5 \\ \end{array}$	$egin{array}{c} 204 \ 239 \ 15.5 \end{array}$	$\begin{bmatrix} 257 \\ 299 \\ 19 \end{bmatrix}$	$\begin{bmatrix} 307 \\ 359 \\ 23 \end{bmatrix}$	$   \begin{array}{r}     358 \\     418 \\     27   \end{array} $	$\begin{vmatrix} 408 \\ 478 \\ 31 \end{vmatrix}$	$\begin{vmatrix} 460 \\ 538 \\ 35 \end{vmatrix}$
-	3 4	$egin{array}{c c} 10.5 \\ 21 \\ 30.5 \end{array}$	$\begin{bmatrix} 21\\40.5\\61\end{bmatrix}$	$\begin{bmatrix} 32\\62.5\\92\end{bmatrix}$	$egin{array}{c} 42.5 \ 83 \ 122.5 \end{array}$	$\begin{bmatrix} 53\\104\\153\end{bmatrix}$	$egin{array}{c c} 63.5 \\ 125 \\ 183.5 \\ \end{array}$	$\begin{array}{c} 74 \\ 146 \\ 214 \end{array}$	$egin{array}{c c} 85 \\ 166.5 \\ 245 \\ \end{array}$	$egin{array}{c c} 95.5 \\ 187.5 \\ 276 \\ \end{array}$
20	$\begin{bmatrix} 5 & 6 \\ 7 & 1 \end{bmatrix}$	$\begin{array}{c c} 41 \\ 51.5 \\ 61 \end{array}$	$\begin{array}{c} 82 \\ 103 \\ 122 \end{array}$	$egin{array}{c} 123 \\ 155 \\ 183.5 \\ \end{array}$	$egin{array}{c} 164 \\ 206 \\ 244 \\ \end{array}$	$egin{array}{c c} 205 \\ 258 \\ 306 \\ \end{array}$	$egin{array}{c} 246 \ 310 \ 367 \ \end{array}$	$\begin{vmatrix} 287 \\ 361 \\ 428 \end{vmatrix}$	328   413   488	369 464 550
22	8 1 2	$\begin{bmatrix} 72.5 \\ 4 \\ 12 \end{bmatrix}$	145 8 23	$\begin{bmatrix} 217 \\ 12 \\ 35 \end{bmatrix}$	$\begin{bmatrix} 290 \\ 16 \\ 47 \end{bmatrix}$	$egin{array}{c c} 362 \\ 21 \\ 59 \\ \end{array}$	$\begin{array}{c c} 435 \\ 25 \\ 71 \end{array}$	506 29 82	580 33 94	$\left \begin{array}{c}651\\37\\106\end{array}\right $
	3 4 5	24 35 48	$\begin{array}{c}48\\71\\96\end{array}$	$\begin{bmatrix} 71\\107\\144 \end{bmatrix}$	$egin{array}{c} 95 \\ 142 \\ 192 \\ \end{array}$	$egin{array}{c c} 119 \\ 178 \\ 240 \\ \end{array}$	$egin{array}{c} 143 \\ 214 \\ 288 \\ \end{array}$	$   \begin{array}{r}     167 \\     249 \\     336   \end{array} $	191 285 384	$begin{bmatrix} 214 \\ 321 \\ 432 \\ \hline \end{bmatrix}$
	6 7 8	$egin{array}{c c} 60 &   \\ 73 &   \\ 85 &  \end{array}$	$ \begin{array}{c c} 121 \\ 146 \\ 170 \end{array} $	$egin{array}{c c} 181 \\ 219 \\ 255 \\ \end{array}$	$egin{array}{c} 242 \ 292 \ 340 \ \end{array}$	$egin{array}{c c} 302 \\ 356 \\ 425 \\ \end{array}$	$egin{array}{c c} 362 &   \\ 439 &   \\ 510 &   \end{array}$	$   \begin{array}{r}     423 \\     512 \\     595   \end{array} $	484 585 680	543 659 765

## MULTIPLE VOLUME TABLE—DOUGLAS FIR

DBH	Logs	1	2	3	4	5	6	7	8.	9
24	$egin{array}{cccccccccccccccccccccccccccccccccccc$	4 14	$\begin{bmatrix} 9\\28 \end{bmatrix}$	$\begin{vmatrix} 13\\42 \end{vmatrix}$	18 56	$\begin{bmatrix} 22 \\ 70 \end{bmatrix}$	27	$\begin{vmatrix} - & & & -31 & - \\ & 99 & & & \end{vmatrix}$	$egin{array}{c c} 36 \\ 113 \end{array}$	$\begin{vmatrix} 40 \\ 127 \end{vmatrix}$
	$\frac{3}{4}$	$\begin{bmatrix} 27 \\ 41 \end{bmatrix}$	54 83	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	109	136 $  207$	164	191	$\begin{vmatrix} 218 \\ 331 \end{vmatrix}$	$\begin{bmatrix} 247 \\ 373 \end{bmatrix}$
	5 6	$\begin{bmatrix} 56 \\ 70 \end{bmatrix}$	$\begin{array}{ c c c }\hline 111\\ 140\\ \end{array}$	$\begin{array}{c c} & 167 \\ \hline & 210 \end{array}$	223 280	$\begin{array}{ c c c } 279 \\ 350 \end{array}$	$\begin{array}{ c c }\hline 335\\ 420\\ \end{array}$	391	446 560	502
26	7 8 1	83 98 5	$ \begin{array}{c} 167 \\ 195 \\ 9 \end{array} $	$\begin{bmatrix} 250 \\ 293 \\ 14 \end{bmatrix}$	$\begin{vmatrix} 334 \\ 391 \\ 19 \end{vmatrix}$	$\begin{array}{ c c c }\hline 418\\ 490\\ 24\\ \end{array}$	$ \begin{array}{c} 501 \\ 586 \\ 29 \end{array} $	585 685 33	$ \begin{array}{ c c c } 668 \\ 782 \\ 38 \end{array} $	752 880 43
20	$\begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$	15 31	$\begin{bmatrix} 31 \\ 63 \end{bmatrix}$	$\begin{vmatrix} 46 \\ 94 \end{vmatrix}$	$\begin{array}{ c c c }\hline 61\\126\\ \end{array}$	77   157	92	108	$\begin{array}{c c} & 33 \\ \hline & 123 \\ \hline & 252 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
	$\begin{bmatrix} & 4 \\ 5 & 3 \end{bmatrix}$	$\begin{bmatrix} 47 \\ 63 \end{bmatrix}$	$\begin{bmatrix} 95 \\ 126 \end{bmatrix}$	$\begin{array}{c c} 142 \\ 190 \end{array}$	$\begin{array}{ c c c c }\hline 190 \\ 253 \\ \end{array}$	$\begin{bmatrix} 238 \\ 317 \end{bmatrix}$	$\begin{array}{ c c c }\hline (285 \\ \hline 380 \\ \hline \end{array}$	$\frac{\begin{bmatrix} 333 \\ 444 \end{bmatrix}}{\begin{bmatrix} 444 \end{bmatrix}}$	380 506	428   570
	$\begin{bmatrix} 6 \\ 7 \end{bmatrix}$	80	$\begin{array}{ c c c c }\hline 161 \\ 196 \\ \hline \end{array}$	242	$\begin{vmatrix} 322 \\ 392 \end{vmatrix}$	403   490	1 484 1 589	565	645	725
28	$\begin{bmatrix} -8\\2\\3 \end{bmatrix}$	$\begin{bmatrix} 113 \\ 17 \\ 36 \end{bmatrix}$	$\begin{bmatrix} 227 \\ 35 \\ 72 \end{bmatrix}$	$\begin{vmatrix} 340 \\ 53 \\ 108 \end{vmatrix}$	$ \begin{vmatrix} 454 \\ 70 \\ 145 \end{vmatrix} $	568   88   181	$egin{array}{c c} 680 \\ 106 \\ 217 \\ \end{array}$	$\begin{array}{c c} + 795 \\ + 123 \\ + 253 \end{array}$	$ \begin{vmatrix} 908 \\ 141 \\ 290 \end{vmatrix} $	$\begin{vmatrix} 1025 \\ 159 \\ 326 \end{vmatrix}$
	4 5 6	55 74 93	110 148 187	$egin{array}{c c} 165 \\ 222 \\ 280 \\ \end{array}$	$egin{array}{c} 220 \\ 296 \\ 374 \\ \end{array}$	275 370 468	330 444 560	$\begin{vmatrix} 385 \\ 518 \\ 655 \end{vmatrix}$	$\begin{vmatrix} 440 \\ 592 \\ 748 \end{vmatrix}$	495 665 840
30	7   8   2	$     \begin{array}{ c c c c }                              $	$\begin{array}{ c c c }\hline 226 \\ 268 \\ 40 \\ \hline \end{array}$	$\begin{bmatrix} 339 \\ 399 \\ 60 \end{bmatrix}$	$\begin{bmatrix} 452 \\ 532 \\ 80 \end{bmatrix}$	565   665   100	678   800   120	$   \begin{vmatrix}     790 \\     930 \\     140   \end{vmatrix} $	$egin{bmatrix} 904 \\ 1065 \\ 160 \\ \end{bmatrix}$	$\begin{vmatrix} 1020 \\ 1197 \\ 180 \end{vmatrix}$
	$\begin{bmatrix} 3\\4\\5 \end{bmatrix}$	40 62 86	$egin{array}{c} 81 \\ 124 \\ 172 \\ \end{array}$	$egin{array}{c} 121 \\ 186 \\ 258 \\ \end{array}$	$ \begin{array}{ c c c c c } \hline 162 \\ 248 \\ 344 \\ \hline \end{array} $	$\begin{bmatrix} 202 \\ 310 \\ 430 \end{bmatrix}$	$egin{array}{c c} 243 \\ 372 \\ 516 \\ \hline \end{array}$	$\begin{bmatrix} 284 \\ 434 \\ 602 \end{bmatrix}$	324 496 688	364 558 774
	$\begin{bmatrix} & 6 \\ 7 \\ 8 \end{bmatrix}$	$egin{array}{c c} 107 \\ 131 \\ 152 \\ \end{array}$	$egin{array}{c c} 214 \\ 262 \\ 304 \\ \end{array}$	$\begin{bmatrix} 321 \\ 393 \\ 456 \end{bmatrix}$	$\begin{bmatrix} 428 \\ 524 \\ 608 \end{bmatrix}$	535 655 760	$\begin{vmatrix} 642 \\ 786 \\ 912 \end{vmatrix}$	$  750 \\ 918 \\   1065 $	$\begin{vmatrix} 856 \\ 1050 \\ 1215 \end{vmatrix}$	$\begin{bmatrix} 963 \\ 1180 \\ 1360 \end{bmatrix}$
32	3 4 5	$egin{array}{c c} 46 \\ 72 \\ 97 \\ \end{array}$	$egin{array}{c c} 93 \\ 143 \\ 194 \\ \end{array}$	$egin{array}{c c} 140 \\ 215 \\ 291 \\ \end{array}$	$ \begin{array}{c} 186 \\ 287 \\ 388 \\  \end{array}$	$\begin{vmatrix} 233 \\ 359 \\ 485 \end{vmatrix}$	280   430   582	$\begin{vmatrix} 326 \\ 503 \\ 680 \end{vmatrix}$	$\begin{vmatrix} 373 \\ 574 \\ 775 \end{vmatrix}$	420   646   875,
	6 7 8 -	$egin{array}{c c} 122 \\ 146 \\ 171 \\ \end{array}$	$egin{bmatrix} 244 \ 293 \ 342 \ \end{bmatrix}$	$\begin{bmatrix} 366 \\ 440 \\ 513 \end{bmatrix}$	488   586   684	$egin{array}{c c} 610 \\ 733 \\ 855 \\ \end{array}$	$egin{array}{c} 732 \\ 880 \\ 1025 \\ \end{array}$	$egin{array}{c} 853 \\ 1025 \\ 1200 \\ \end{array}$	$\begin{vmatrix} 975 \\ 1170 \\ 1370 \end{vmatrix}$	$\begin{vmatrix} 1100 \\ 1320 \\ 1540 \end{vmatrix}$
34	3   4   5	$\begin{bmatrix} 52 \\ 82 \\ 108 \end{bmatrix}$	$egin{array}{c c} 105 \\ 164 \\ 216 \\ \end{array}$	$egin{array}{c c} 158 \\ 246 \\ 324 \\ \end{array}$	$ \begin{array}{c} 210 \\ 328 \\  \begin{array}{c} 432 \end{array}$	263   410   540	$\begin{array}{ c c c }\hline & 31\overline{6} \\ 493 \\ \hline & 648 \\ \end{array}$	$\begin{vmatrix} 368 \\ 574 \\ 756 \end{vmatrix}$	$\begin{bmatrix} 421 \\ 656 \\ 864 \end{bmatrix}$	$\begin{vmatrix} 474 \\ 738 \\ 972 \end{vmatrix}$
	6 7 8	137   164   194	274   328   388	$ \begin{array}{ c c c } 412 \\ 492 \\ 582 \end{array} $	548 656 776	685   820   970	$oxed{822} \ 985 \ 1165$	$egin{array}{c} 960 \\ 1150 \\ 1360 \\ \end{array}$	$egin{array}{c} 1096 \\ 1310 \\ 1550 \\ \end{array}$	$\begin{vmatrix} 1230 \\ 1475 \\ 1745 \end{vmatrix}$
3 6	10 3	$egin{array}{c} 222 \ 251 \ 59 \ \end{array}$	444 502 118	$ \begin{array}{c c} 666 \\ 753 \\ 177 \end{array} $	$egin{array}{c c} 888 \\ 1004 \\ 236 \\ \end{array}$	$ 1110 \\  1255 \\  295$	$\begin{vmatrix} 1330 \\ 1506 \\ 354 \end{vmatrix}$	$ 1550 \\  1757 \\  414$	$\begin{vmatrix} 1775 \\ 2008 \\ 472 \end{vmatrix}$	$\begin{vmatrix} 2000 \\ 2260 \\ 530 \end{vmatrix}$
	5 6	$egin{array}{c} 99 \ 119 \ 152 \ \end{array}$	$egin{array}{c} 198 \\ 238 \\ 305 \\ \end{array}$	297 357 458	$egin{array}{c c} 396 \\ 476 \\ 610 \\ \end{array}$	$\begin{vmatrix} 495 \\ 595 \\ 762 \end{vmatrix}$	594 715 915	694 835 1168	$egin{array}{c} 793 \\ 953 \\ 1220 \\ \end{array}$	1070 1370
	7 8 9	$ \begin{array}{c} 184 \\ 213 \\ 245 \\  \end{array}$	368 426 490	552 640 735	735   850   980	$\begin{vmatrix} 920 \\ 1065 \\ 1230 \end{vmatrix}$	$ 1100 \\  1280 \\  1470$	$\begin{vmatrix} 1285 \\ 1490 \\  1720 \end{vmatrix}$	$\begin{vmatrix} 1470 \\ 1700 \\ 1965 \end{vmatrix}$	$\begin{bmatrix} 1650 \\ 1915 \\ 2210 \end{bmatrix}$

## MULTIPLE VOLUME TABLE—DOUGLAS FIR

DBH	Logs	1	2	3	4	5	6	7	8	9
38	10	$egin{array}{c} 278 \\ 65 \\ 97 \\ \hline \end{array}$	$\begin{vmatrix} 556 \\ 131 \\ 195 \end{vmatrix}$	$egin{array}{c} 835 \\ 196 \\ 293 \\ \end{array}$	$\begin{vmatrix} 1110 \\ 262 \\ 390 \end{vmatrix}$	$\begin{vmatrix} 1390 \\ 328 \\ 488 \end{vmatrix}$	$\begin{vmatrix} 1665 \\ 393 \\ 586 \end{vmatrix}$	$\begin{vmatrix} 1945 \\ 458 \\ 684 \end{vmatrix}$	$egin{array}{c} 2220 \\ 524 \\ 782 \\ \end{array}$	$\begin{bmatrix} 2500 \\ 590 \\ 880 \end{bmatrix}$
	5 6 7	$egin{array}{c} 133 \\ 167 \\ 200 \\ \end{array}$	$egin{array}{c} 267 \ 332 \ 401 \ \end{array}$	400 502 601	534 670 802	$ \begin{array}{ c c c }  & 667 \\  & 837 \\  & 902 \\ \end{array} $	$\begin{vmatrix} 800 \\ 1005 \\ 1203 \end{vmatrix}$	$\begin{vmatrix} 935 \\ 1170 \\ 1403 \end{vmatrix}$	$\begin{vmatrix} 1070 \\ 1340 \\ 1604 \end{vmatrix}$	$\begin{vmatrix} 1200 \\ 1510 \\ 1804 \end{vmatrix}$
	$\begin{bmatrix} 8\\9\\10 \end{bmatrix}$	$egin{array}{c} 234 \ 271 \ 306 \ \end{array}$	$ \begin{array}{ c c c c } 468 \\ 542 \\ 612 \end{array} $	700 813 918	$egin{array}{c} 946 \ 1080 \ 1225 \ \end{array}$	$\begin{vmatrix} 1170 \\ 1350 \\ 1530 \end{vmatrix}$	$  1405 \\   1625 \\   1840  $	$\begin{vmatrix} 1640 \\ 1895 \\ 2140 \end{vmatrix}$	$\begin{bmatrix} 1870 \\ 2160 \\ 2450 \end{bmatrix}$	$\begin{bmatrix} 2100 \\ 2440 \\ 2760 \end{bmatrix}$
40	4 5 6	$egin{array}{c} 108 \\ 146 \\ 182 \\ \end{array}$	$egin{array}{c c} 217 \\ 293 \\ 364 \\ \end{array}$	$\begin{vmatrix} 326 \\ 440 \\ 546 \end{vmatrix}$	434   586   730	$ \begin{array}{c} 543 \\ 734 \\ 910 \end{array} $	$\begin{vmatrix} 650 \\ 880 \\ 1090 \end{vmatrix}$	$egin{array}{c} 760 \\ 1025 \\ 1275 \\ \end{array}$	868 1170 1455	$\begin{vmatrix} 977 \\ 1320 \\ 1640 \end{vmatrix}$
	$\begin{bmatrix} 7\\8\\9\\10 \end{bmatrix}$	$egin{array}{c} 222 \\ 261 \\ 298 \\ 340 \\ \end{array}$	$   \begin{vmatrix}     445 \\     522 \\     597 \\     680   \end{vmatrix} $	$\begin{bmatrix} 667 \\ 783 \\ 896 \\ 1020 \end{bmatrix}$	$egin{array}{c} 890 \\ 1040 \\ 1190 \\ 1360 \\ \end{array}$	$\begin{vmatrix} 1110 \\ 1300 \\ 1485 \\ 1700 \end{vmatrix}$	$\begin{vmatrix} 1335 \\ 1565 \\ 1790 \\ 2040 \end{vmatrix}$	$ \begin{array}{r}  1560  \\  1825  \\  2090  \\  2380  \end{array} $	$   \begin{array}{c c}     1780 \\     2080 \\     2390 \\     2720   \end{array} $	$\begin{vmatrix} 2000 \\ 2350 \\ 2690 \\ 3060 \end{vmatrix}$

## MULTIPLE VOLUME TABLE—SPRUCE

(Constructed by the Frustum Form Factor method. Based on 189 trees from the Blackfeet and Lolo National Forests.) Scribner Decimal C. Rule.

DBH	Logs	1	2	3	4	5	6	7	8	9
8	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$egin{array}{c} 2.5 \ 5.0 \ 7.5 \ \end{array}$	$ \begin{array}{c c} 5.5 \\ 10.0 \\ 15.5 \end{array} $	$ \begin{array}{ c c } \hline 8.0 \\ 13.0 \\ 23.0 \end{array} $	$\begin{array}{ c c c c }\hline & 11.0 \\ & 17.5 \\ & 31.0 \\ \hline \end{array}$	$ \begin{array}{c c}  & 13.5 \\  & 22.0 \\  & 38.5 \end{array} $	$\begin{array}{ c c c }\hline 16.0 \\ 26.5 \\ 46.0 \\ \hline \end{array}$	$ \begin{array}{c c}  & 19.0 \\  & 31.0 \\  & 54.0 \end{array} $	$\begin{array}{ c c c c }\hline 21.5 \\ 35.0 \\ 61.5 \\ \hline \end{array}$	$\begin{bmatrix} 24.5 \\ 39.5 \\ 69.5 \end{bmatrix}$
10	4 12	$egin{array}{c} 10.5 \ 2.5 \ 5.5 \ \end{array}$	$\begin{array}{ c c c }\hline 21.0 \\ 5.5 \\ 10.5 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 32.0 \\ 8.0 \\ 16.0 \\ \hline \end{array}$	$\begin{array}{ c c c c }\hline & 42.5 \\ & 11.0 \\ & 21.0 \\ \hline \end{array}$	$\begin{array}{ c c c c c c }\hline 53.0 \\ 14.0 \\ 26.5 \\ \hline \end{array}$	$\begin{array}{ c c c c c c } \hline & 63.5 \\ & 16.5 \\ & 32.0 \\ \hline \end{array}$	$\begin{bmatrix} 74.0 \\ 19.0 \\ 37.0 \end{bmatrix}$	$\begin{bmatrix} 85.0 \\ 22.0 \\ 42.5 \end{bmatrix}$	$\begin{array}{ c c c c c }\hline 95.5 \\ 25.0 \\ 47.5 \\ \end{array}$
12	$\begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix}$	$egin{array}{c} 9.0 \\ 12.5 \\ 3.0 \\ \end{array}$	$\begin{array}{ c c c }\hline 18.0 \\ 25.0 \\ 6.0 \\ \hline \end{array}$	$ \begin{array}{c c} 27.0 \\ 37.5 \\ 9.0 \end{array} $	$egin{array}{c} 36.0 \ 50.0 \ 12.0 \ \end{array}$	$\begin{array}{ c c c }\hline 45.0 \\ 62.5 \\ 15.0 \\ \hline \end{array}$	$ \begin{array}{c c} 54.0 \\ 75.0 \\ 17.5 \end{array} $	$\begin{array}{c} 63.0 \\ 87.5 \\ 20.5 \end{array}$	$\begin{array}{ c c c }\hline 72.0 \\ 100.0 \\ 23.5 \\ \hline \end{array}$	$\begin{array}{c c} 81.0 \\ 112.5 \\ 26.5 \end{array}$
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	$6.0 \\ 10.5 \\ 15.5$	$\begin{array}{ c c c }\hline 12.5 \\ 21.0 \\ 31.0 \\ \hline \end{array}$	$ \begin{array}{c c} 18.5 \\ 32.0 \\ 46.0 \end{array} $	$\begin{array}{ c c c }\hline 24.5 \\ 42.5 \\ 61.5 \\ \end{array}$	$egin{array}{c c} 31.0 \\ 53.0 \\ 77.0 \\ \end{array}$	$ \begin{array}{c c} 37.0 \\ 63.5 \\ 92.5 \end{array} $	$\begin{array}{c c} 43.0 \\ 74.0 \\ 108.0 \end{array}$	$ \begin{array}{ c c c } 49.0 \\ 85.0 \\ 123.0 \end{array} $	$oxed{55.5} \ 95.5 \ 139.0$
14	$\begin{bmatrix} 1\\2\\3 \end{bmatrix}$	$\begin{array}{c} 3.0 \\ 7.0 \\ 13.0 \end{array}$	$\begin{array}{ c c c } & 6.5 \\ 14.0 \\ 26.5 \end{array}$	$9.5 \\ 21.5 \\ 39.5$	$\begin{array}{ c c c }\hline 12.5 \\ 28.5 \\ 53.0 \\ \end{array}$	$egin{array}{c} 15.5 \ 36.0 \ 66.0 \ \end{array}$	$ \begin{array}{c c} 19.0 \\ 43.0 \\ 79.0 \end{array} $	$ \begin{array}{c c} 22.0 \\ 50.0 \\ 92.5 \end{array} $	$oxed{25.0} \ 58.0 \ 105.0$	$\begin{bmatrix} 28.5 \\ 64.5 \\ 119.0 \end{bmatrix}$
16	$egin{array}{c c} 4 & \ 5 & \ 1 & \ \end{array}$		$egin{array}{c} 37.5 \ 50.0 \ 7.0 \ \end{array}$	$56.5 \\ 75.0 \\ 10.5$	$egin{array}{c} 75.0 \ 100.0 \ 14.0 \ \end{array}$	$\begin{array}{ c c c c }\hline 94.0 \\ 125.0 \\ 17.5 \\ \end{array}$	$egin{array}{c c} 113.0 \\ 150.0 \\ 21.0 \\ \end{array}$	$131.5 \\ 175.0 \\ 25.0$	$\begin{bmatrix} 150.0 \\ 200.0 \\ 28.0 \end{bmatrix}$	$\left \begin{array}{c} 169.0 \\ 225.0 \\ 32.0 \end{array}\right $
	2 3 4	$8.5 \\ 16.0 \\ 23.5$	$ \begin{array}{c c} 17.5 \\ 32.0 \\ 47.0 \end{array} $	$ \begin{array}{r} 26.0 \\ 48.5 \\ 70.5 \end{array} $	$\begin{bmatrix} 35.0 \\ 64.5 \\ 94.0 \end{bmatrix}$	$\begin{array}{r r} 43.5 \\ 80.5 \\ 117.5 \end{array}$	$\begin{bmatrix} 52.0 \\ 96.5 \\ 141.0 \end{bmatrix}$	$61.0 \\ 113.0 \\ 164.5$	$\begin{bmatrix} 69.5 \\ 129.0 \\ 188.0 \end{bmatrix}$	$egin{array}{c c} 78.0 \\ 145.0 \\ 211.0 \\ \end{array}$
18	$egin{array}{c c} 5 \ 1 \ 2 \end{array}$	$ \begin{array}{c} 31.0 \\ 4.0 \\ 10.0 \end{array} $	$egin{array}{c} 61.5 \ 8.0 \ 20.0 \ \end{array}$	$\begin{array}{c} 92.5 \\ 12.0 \\ 30.0 \end{array}$	$egin{array}{c} 123.0 \\ 16.0 \\ 40.5 \\ \end{array}$	$egin{array}{c} 154.0 \ 20.0 \ 50.5 \ \end{array}$	$egin{array}{c} 185.0 \\ 23.5 \\ 60.5 \\ \end{array}$	$216.0 \\ 27.5 \\ 70.5$	$\begin{array}{c} 246.0 \\ 31.5 \\ 81.0 \end{array}$	$egin{array}{c c} 278.0 &   & & & & \\ 35.5 &   & & & \\ 91.0 &   & & & \\ \end{array}$
•	3 4 5	$19.0 \\ 29.0 \\ 38.0$	$   \begin{array}{r}     38.0 \\     58.0 \\     76.0   \end{array} $	$   \begin{array}{r}     56.5 \\     87.0 \\     114.0   \end{array} $	$75.5 \\ 116.0 \\ 152.0$	$\begin{array}{c} 94.5 \\ 145.0 \\ 190.0 \end{array}$	$\begin{array}{ c c c }\hline 163.0 \\ 174.0 \\ 228.0 \\ \end{array}$	$   \begin{array}{c}     132.0 \\     203.0 \\     266.0   \end{array} $	$\begin{array}{c} 151.0 \\ 232.0 \\ 320.0 \end{array}$	$begin{array}{c c} 170.0 \\ 261.0 \\ 342.0 \\ \hline \end{array}$
20	$\begin{bmatrix} 6 \\ 1 \\ 2 \end{bmatrix}$	$egin{array}{c} 47.0 \ 4.5 \ 12.0 \ \end{array}$	$ \begin{array}{c c} 94.0 \\ 8.5 \\ 24.0 \end{array} $	$\begin{array}{c c} 141.0 \\ 13.0 \\ 35.5 \end{array}$	$\begin{array}{c c} 188.0 & \\ 17.0 & \\ 47.5 & \end{array}$	$egin{array}{c} 235.0 \ 21.5 \ 59.0 \ \end{array}$	$begin{array}{c c} 282.0 \\ 26.0 \\ 71.0 \\ \hline \end{array}$	$ \begin{array}{c c} 329.0 \\ 30.0 \\ 83.0 \end{array} $	$ \begin{array}{c c} 376.0 \\ 34.5 \\ 95.0 \end{array} $	$\begin{array}{c c} 423.0 \\ 38.5 \\ 107.0 \end{array}$
	3 4 5	$   \begin{array}{r}     23.5 \\     34.0 \\     46.0   \end{array} $	$ \begin{array}{c} 46.5 \\ 68.5 \\ 92.0 \end{array} $	$70.0 \\ 102.5 \\ 137.5$	$93.0 \\ 137.0 \\ 183.5$	$egin{array}{c} 116.5 \ 172.0 \ 229.0 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	$egin{array}{c c} 140.0 & \\ 205.0 & \\ 275.0 & \\ \end{array}$	$\begin{array}{c c} 163.0 \\ 239.0 \\ 321.0 \end{array}$	$\begin{array}{c} 186.0 \\ 274.0 \\ 367.0 \end{array}$	$\begin{array}{c c} 210.0 \\ 308.0 \\ 413.0 \end{array}$
22	$egin{array}{c c} 6 & 1 \ 1 & 2 \end{array}$	57.5 4 13	$\begin{array}{c c} 114.0 \\ 9 \\ 27 \end{array}$	$egin{array}{c c} 172.0 & \\ 14 & \\ 41 & \\ \end{array}$	$egin{array}{c c} 228.0 & & & \\ 19 & & & \\ 54 & & & & \\ \end{array}$	$\begin{bmatrix}285.0\\24\\68\end{bmatrix}$	$\begin{bmatrix} 342.0 \\ 28 \\ 81 \end{bmatrix}$	400.0 33 95	$ \begin{array}{c c} 456.0 \\ 38 \\ 109 \end{array} $	$\begin{bmatrix} 514.0 \\ 43 \\ 122 \end{bmatrix}$
	3 4 5	27 40 55	54 81 110	$   \begin{array}{c c}     82 \\     122 \\     165   \end{array} $	$egin{array}{c c} 109 &   \\ 162 &   \\ 220 &   \end{array}$	$\begin{bmatrix} 136 \\ 203 \\ 275 \end{bmatrix}$	$egin{array}{c c} 164 &   \\ 244 &   \\ 330 &   \\ \end{array}$	$   \begin{array}{c c}     191 \\     284 \\     385   \end{array} $	$     \begin{array}{c c}     218 \\     325 \\     440   \end{array} $	246 365 495
24	$\begin{bmatrix} 6 \\ 7 \\ 1 \end{bmatrix}$	69 84 5	$   \begin{array}{c c}     138 \\     168 \\     10   \end{array} $	$\begin{bmatrix} 207 \\ 252 \\ 15 \end{bmatrix}$	$\begin{bmatrix} 276 \\ 336 \\ 21 \end{bmatrix}$	$\begin{bmatrix} 345 \\ 420 \\ 26 \end{bmatrix}$	414 504 31	483 588 36	$\begin{bmatrix} 552 \\ 670 \\ 41 \end{bmatrix}$	620 755 47
	2 3 4	$\begin{bmatrix} 16\\31\\48 \end{bmatrix}$	32 63 96	49 95 144	$egin{array}{c c} 65 &   \\ 126 &   \\ 192 &   \\ \end{array}$	$\begin{bmatrix} 81 \\ 158 \\ 240 \end{bmatrix}$	$   \begin{array}{c c}     98 \\     190 \\     288   \end{array} $	$\begin{bmatrix} 114 \\ 221 \\ 336 \end{bmatrix}$	$\begin{bmatrix} 130 \\ 253 \\ 384 \end{bmatrix}$	$\begin{bmatrix} 147 \\ 284 \\ 432 \end{bmatrix}$
	$\begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$	$\begin{bmatrix} 64 \\ 81 \\ 97 \end{bmatrix}$	$   \begin{array}{c c}     129 \\     162 \\     194   \end{array} $	$   \begin{array}{c c}     193 \\     243 \\     290   \end{array} $	$\begin{bmatrix} 258 \\ 324 \\ 387 \end{bmatrix}$	323 405 484	387 486 580	452 568 677	$\begin{bmatrix} 516 \\ 650 \\ 765 \end{bmatrix}$	581 730 870

## MULTIPLE VOLUME TABLE—SPRUCE

_			1	1		1	1	1		
DBH	Logs	1	$\begin{vmatrix} 2 \end{vmatrix}$	3	4	5	6	7	8	9
26	2 3 4	18 37 55	$egin{array}{c} 36 \\ 74 \\ 111 \\ \end{array}$	$egin{array}{c} 54 \\ 110 \\ 167 \\ \end{array}$	72 147 222	$egin{array}{c c} 90 \\ 184 \\ 278 \\ \end{array}$	$\begin{vmatrix} 108 \\ 221 \\ 334 \end{vmatrix}$	$\begin{vmatrix} 126 \\ 258 \\ 390 \end{vmatrix}$	$ \begin{array}{ c c c c } \hline 144 \\ 295 \\ 445 \\ \hline \end{array} $	$\left  \begin{array}{c} 162 \\ 332 \\ 500 \end{array} \right $
	5 6 7	$   \begin{vmatrix}     74 \\     94 \\     115   \end{vmatrix} $	$ \begin{array}{ c c c } 149 \\ 189 \\ 230 \end{array} $	223 284 345	$egin{array}{c} 298 \\ 378 \\ 460 \\ \hline \end{array}$	$\begin{vmatrix} 372 \\ 472 \\ 575 \end{vmatrix}$	446   566   690	$\begin{bmatrix} 520 \\ 660 \\ 805 \end{bmatrix}$	$\begin{vmatrix} 595 \\ 755 \\ 920 \end{vmatrix}$	$\begin{vmatrix} 670 \\ 850 \\ 1035 \end{vmatrix}$
28	3 4 5	42 64 86	84   127   174	$egin{array}{c c} 126 \\ 191 \\ 258 \\ \hline \end{array}$	$egin{array}{c c} 168 \\ 255 \\ 344 \\ \end{array}$	$ \begin{array}{r r}  & 210 \\  & 319 \\  & 430 \end{array} $	$egin{array}{c} 252 \\ 383 \\ 516 \\ \hline \end{array}$	$\begin{vmatrix} 294 \\ 447 \\ 600 \end{vmatrix}$	$\begin{vmatrix} 336 \\ 510 \\ 688 \end{vmatrix}$	378 574 774
	6 7 8	108 131 154	217 262 308	325 393 462	434 524 616	543 655 770	650   786   925	$\begin{bmatrix} 760 \\ 917 \\ 1080 \end{bmatrix}$	$\begin{vmatrix} 868 \\ 1050 \\ 1230 \end{vmatrix}$	$\begin{bmatrix} 976 \\ 1180 \\ 1390 \end{bmatrix}$
30	3 4 5	$egin{array}{c} 46 \\ 71 \\ 99 \\ 122 \\ \end{array}$	$ \begin{array}{ c c c c c c } \hline 94 \\ 143 \\ 198 \\ \hline \end{array} $	$egin{array}{c c} 140 \\ 214 \\ 297 \\ \hline \end{array}$	$ \begin{array}{ c c c c } \hline 186 \\ 286 \\ 395 \\ \hline \end{array} $	233 357 494	$ \begin{array}{ c c c c c }  & 279 \\  & 430 \\  & 594 \\ \hline  & & 740 \\ \end{array} $	$\begin{vmatrix} 326 \\ 500 \\ 692 \end{vmatrix}$	$\begin{vmatrix} 373 \\ 572 \\ 790 \end{vmatrix}$	420   644   890
9.0	6 7 8	$egin{array}{c c} 123 \\ 150 \\ 175 \\ \hline \end{array}$	246 300 350	$\begin{vmatrix} 368 \\ 450 \\ 524 \end{vmatrix}$	492 600 700	$egin{array}{c c} 615 \\ 750 \\ 7875 \\ \hline 266 \\ \end{array}$	740 900 1050	$egin{array}{c} 860 \\ 1050 \\ 1225 \\ \hline \end{array}$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1100 1350 1750
32	3 4 5	53 81 110	$ \begin{array}{ c c c c } \hline 106 \\ 167 \\ 220 \\ \hline \end{array} $	159 245 330	$ \begin{array}{ c c c c c } \hline 212 \\ 327 \\ 440 \\ \hline -550 \end{array} $	$egin{array}{c c} 266 \\ 409 \\ 550 \\ \hline \end{array}$	$ \begin{array}{ c c c c c } \hline 319 \\ 490 \\ 660 \\ \hline \end{array} $	372 570 770	$\begin{array}{ c c c }\hline 425 \\ 650 \\ 880 \\ \hline \end{array}$	478   735   990
2.4	6 7 8	$\begin{vmatrix} 139 \\ 167 \\ 195 \end{vmatrix}$	278 334 390	417 500 585	556 670 780	695   836   975	834  1000  1170	$\begin{vmatrix} 973 \\ 1170 \\ 1365 \end{vmatrix}$	$\begin{vmatrix} 1110 \\ 1335 \\ 1560 \end{vmatrix}$	$ \begin{vmatrix} 1250 \\ 1500 \\ 1750 \end{vmatrix} $
34	3 4 5	57 88 117	$ \begin{array}{ c c c c c } \hline 114 \\ 177 \\ 234 \\ \hline \end{array} $	$ \begin{array}{ c c c c c } \hline 171 \\ 266 \\ 350 \\ \hline \end{array} $	$\begin{vmatrix} 228 \\ 354 \\ 466 \\ \hline & 200 \end{vmatrix}$	285	342 530 700	$ig  egin{array}{c} 400 \\ 620 \\ 816 \\ \hline \end{array}$	$ \begin{array}{ c c c c c } 456 \\ 710 \\ 934 \\ \hline \end{array} $	$egin{array}{c c} 513 \\ 796 \\ 1050 \\ \end{array}$
0.0	6 7 8	148 177 210	$\begin{vmatrix} 296 \\ 354 \\ 420 \end{vmatrix}$	434 530 630	$ \begin{array}{ c c c c c } \hline 593 \\ 710 \\ 840 \\ \hline \end{array} $	740   885  1050	$\begin{vmatrix} 890 \\ 1060 \\  1260 \end{vmatrix}$	$\begin{vmatrix} 1035 \\ 1240 \\ 1470 \end{vmatrix}$	$\begin{vmatrix} 1185 \\ 1420 \\ 1680 \end{vmatrix}$	$\begin{vmatrix} 1330 \\ 1590 \\ 1890 \end{vmatrix}$
36	3 4 5 5	$ \begin{array}{ c c c c c } 61 \\ 93 \\ 125 \\ \end{array} $	$ \begin{array}{c c} 123 \\ 186 \\ 250 \end{array} $	$egin{array}{c} 185 \\ 279 \\ 375 \\ \end{array}$	$\begin{array}{ c c c }\hline 246 \\ 372 \\ 500 \\\hline \end{array}$	308 465 625	369 558 750	$\begin{array}{ c c c }\hline 430 \\ 650 \\ 875 \\ \hline \end{array}$	$ \begin{array}{ c c c c c } 493 \\ 745 \\ 1000 \end{array} $	554   836   1250
,	6 7 8	$ \begin{array}{ c c c }  & 160 \\  & 192 \\  & 224 \\  & & & & \\  & & & & \\  & & & & & \\  & & & &$	320 384 448	480 575 670	640 770 895	800   960  1120	$\begin{vmatrix} 960 \\ 1150 \\ 1340 \end{vmatrix}$	$   \begin{array}{c c}      1120 \\      1345 \\      1560 \\   \end{array} $	$\begin{vmatrix} 1280 \\ 1540 \\ 1790 \end{vmatrix}$	$\begin{vmatrix} 1440 \\ 1730 \\ 2010 \end{vmatrix}$
38	3 4 5 5	$ \begin{array}{ c c c c c } 67 \\ 100 \\ 136 \\ \hline \end{array} $	$\begin{vmatrix} 134 \\ 200 \\ 273 \end{vmatrix}$	201 300 410	268 400 545	335 500 583	400   600   820	470   700   955	$\begin{bmatrix} 536 \\ 800 \\ 1090 \\ \end{bmatrix}$	$ \begin{vmatrix} 604 \\ 900 \\ 1225 \end{vmatrix} $
- 10	6 7 8	$egin{array}{c c} 171 \\ 205 \\ 239 \\ \hline \end{array}$	342 410 480	$egin{array}{c c} 514 \\ 615 \\ 720 \\ \hline \end{array}$	$\begin{bmatrix} 685 \\ 820 \\ 955 \end{bmatrix}$	$egin{array}{c} 855 \\ 1025 \\ 1190 \\ \end{array}$	$egin{array}{c}  1025 \\  1230 \\  1430 \\ \end{array}$	$ \begin{array}{c c}  1190 \\  1435 \\  1670 \end{array} $	$\begin{vmatrix} 1370 \\ 1640 \\ 1910 \end{vmatrix}$	$   \begin{array}{c c}     1540 \\     1845 \\     2150   \end{array} $
40	5 6	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	222 300 372	$\begin{vmatrix} 333 \\ 450 \\ 558 \end{vmatrix}$	444 600 745	555   750   930	666   900  1115	777 1050 1300	$\begin{vmatrix} 888 \\ 1200 \\ 1490 \\ \end{vmatrix}$	999 1350 1675
	8	228	456 534	685 800	$\begin{vmatrix} 910 \\ 1170 \end{vmatrix}$	$\begin{vmatrix} 1140 \\ 1330 \end{vmatrix}$	1370  $ 1600 $	1600 1865	$\begin{vmatrix} 1820 \\ 2130 \end{vmatrix}$	$\begin{bmatrix} 2025 \\ 2400 \end{bmatrix}$

## MULTIPLE VOLUME TABLE—BALSAM

(Constructed by the Frustum Form Factor method. Basis: 33 trees from the Blackfeet National Forest.) Scribner Decimal C Rule.

DBH	Logs	1	2	3	4	5	6	7	8	9
8	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{bmatrix} 2.5 \\ 5.0 \\ 8.0 \end{bmatrix}$	$\begin{bmatrix} 5\\10\\16 \end{bmatrix}$	$egin{array}{c c} 7.5 & 15.0 & 24.0 & \end{array}$	$\begin{array}{c} 10 \\ 20 \\ 32 \end{array}$	$begin{pmatrix} 12.5 \ 25.0 \ 40.0 \ \end{bmatrix}$	15 30 48	$17.5 \\ 35.0 \\ 56.0$	$\begin{array}{c} 20 \\ 40 \\ 64 \end{array}$	$\begin{bmatrix} 22.5 \\ 45.0 \\ 72.0 \end{bmatrix}$
10	$egin{bmatrix} 4 & 1 \ 1 & 2 \end{bmatrix}$	$egin{array}{c} 9.0 \ 3.0 \ 5.5 \ \end{array}$	$\begin{array}{c} 18 \\ 6 \\ 11 \end{array}$	$egin{array}{c} 27.0 \ 9.0 \ 16.5 \ \end{array}$	$\begin{array}{c} 36 \\ 12 \\ 22 \end{array}$	$\begin{array}{ c c c }\hline 45.0 \\ 15.0 \\ 27.5 \\ \hline \end{array}$	54 18 33	$63.0 \\ 21.0 \\ 38.5$	$\begin{array}{c} 72 \\ 24 \\ 44 \end{array}$	$\left \begin{array}{c} 81.0 \\ 27.0 \\ 49.5 \end{array}\right $
12	3 4 1	$egin{array}{c} 9.5 \\ 13.0 \\ 3.0 \\ \end{array}$	$\begin{array}{c} 19 \\ 26 \\ 6 \end{array}$	$ \begin{array}{c c} 28.5 \\ 39.0 \\ 9.0 \end{array} $	$egin{array}{c} 38 \ 52 \ 12 \ \end{array}$	$\begin{array}{ c c c } & 47.5 \\ & 65.0 \\ & 15.0 \\ \end{array}$	57 78 18	$\begin{array}{c} 66.5 \\ 91.0 \\ 21.0 \end{array}$	$\begin{array}{c} 76 \\ 104 \\ 24 \end{array}$	$\begin{array}{ c c c }\hline 85.5 \\ 117.0 \\ 27.0 \\ \end{array}$
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	$\begin{array}{c c} 6.5 \\ 11.0 \\ 16.0 \end{array}$	$\begin{bmatrix} 13\\22\\32\end{bmatrix}$	$ \begin{array}{c c} 19.5 \\ 33.0 \\ 48.0 \end{array} $	$\begin{array}{c} 26 \\ 44 \\ 64 \end{array}$	$\begin{bmatrix} 32.5 \\ 55.0 \\ 80.0 \end{bmatrix}$	$\begin{bmatrix} 39\\ 66\\ 96 \end{bmatrix}$	$\begin{array}{c c} 45.5 \\ 77.0 \\ 112.0 \end{array}$	$\begin{bmatrix} 52\\88\\128 \end{bmatrix}$	$ \begin{array}{c c} 58.5 \\ 99.0 \\ 144.0 \end{array} $
14	$egin{bmatrix} 1 & \cdot \ 2 \ 3 \end{bmatrix}$	$\begin{bmatrix} 3.5 \\ 7.5 \\ 14.0 \end{bmatrix}$	$\begin{array}{c} 7 \\ 15 \\ 28 \end{array}$	$egin{array}{c} 10.5 \ 22.5 \ 42.0 \ \end{array}$	$\begin{array}{c} 14\\30\\56\end{array}$	$ \begin{array}{c c} 17.5 \\ 37.5 \\ 70.0 \end{array} $	21 45 84	$ \begin{array}{r} 24.5 \\ 52.5 \\ 98.0 \end{array} $	$\begin{array}{c} 28 \\ 60 \\ 112 \end{array}$	$\begin{array}{ c c c }\hline 31.5 \\ 75.0 \\ 126.0 \\ \end{array}$
16	4 5 1	$   \begin{array}{r}     19.5 \\     26.0 \\     3.5   \end{array} $	$\begin{array}{c} 39\\52\\7\end{array}$	$58.5 \\ 78.0 \\ 10.5$	$\begin{array}{c} 78 \\ 108 \\ 14 \end{array}$	$ \begin{array}{ c c c c c } \hline 97.5 \\ 135.0 \\ 17.5 \end{array} $	$\begin{array}{c} 117 \\ 162 \\ 21 \end{array}$	$ \begin{array}{r} 136.5 \\ 189.0 \\ 24.5 \end{array} $	$egin{array}{c} 156 \\ 216 \\ 28 \\ \end{array}$	$\begin{array}{ c c c c }\hline 175.0 \\ 243.0 \\ 31.5 \\ \hline \end{array}$
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	$\begin{array}{c} 9.0 \\ 17.0 \\ 22.5 \end{array}$	18 34 45	$ \begin{array}{c c} 27.0 \\ 51.0 \\ 67.5 \end{array} $	36 68 90	$\begin{array}{ c c c }\hline 45.0 \\ 85.0 \\ 112.5 \\ \hline \end{array}$	$   \begin{array}{r}     54 \\     102 \\     135   \end{array} $	$\begin{array}{c c} 63.0 \\ 119.0 \\ 157.5 \end{array}$	$\begin{array}{c} 72 \\ 136 \\ 180 \end{array}$	$\begin{vmatrix} 81.0 \\ 153.0 \\ 202.5 \end{vmatrix}$
18	$\begin{array}{c c} 5 \\ 1 \\ 2 \end{array}$	$egin{array}{c} 32.0 \\ 4.0 \\ 10.5 \\ \end{array}$	$\begin{bmatrix} 64\\8\\21 \end{bmatrix}$	$\begin{array}{ c c c c }\hline 96.0 \\ 12.0 \\ 31.5 \\ \hline \end{array}$	$\begin{array}{c} 128 \\ 16 \\ 42 \end{array}$	$\begin{array}{ c c c }\hline 160.0 \\ 20.0 \\ 52.5 \\ \hline \end{array}$	$\begin{array}{c c} 192 \\ 24 \\ 63 \end{array}$	$ \begin{array}{ c c c c c } \hline 224.0 \\ 28.0 \\ 73.5 \end{array} $	$\begin{bmatrix} 256\\ 32\\ 84 \end{bmatrix}$	$\left \begin{array}{c c} 288.0 \\ 36.0 \\ 94.5 \end{array}\right $
	3 4 5	$egin{array}{c} 20.0 \ 30.5 \ 40.0 \ \end{array}$	40 61 80	$\begin{bmatrix} 60.0 \\ 91.5 \\ 120.0 \end{bmatrix}$	$egin{array}{c} 80 \\ 122 \\ 160 \\ \end{array}$	$oxed{100.0}{152.5}{200.0}$	$egin{array}{c} 120 \\ 183 \\ 240 \end{array}$	$\begin{array}{ c c c }\hline 140.0 \\ 213.5 \\ 280.0 \\ \hline \end{array}$	$egin{array}{c} 160 \\ 244 \\ 320 \\ \end{array}$	$\begin{array}{ c c c }\hline & 180.0 \\ & 274.5 \\ & 360.0 \\ \end{array}$
20	$egin{pmatrix} 1 \ 2 \ 3 \end{bmatrix}$	$egin{array}{c c} 4.5 & 12.5 \ 25.0 & \end{array}$	$\begin{array}{c} 9 \\ 25 \\ 50 \end{array}$	$egin{array}{c} 13.5 \ 37.5 \ 75.0 \ \end{array}$	$\begin{array}{c} 18 \\ 50 \\ 100 \end{array}$	$egin{array}{c c} 22.5 & 62.5 \ 62.5 & 125.0 \ \end{array}$	$\begin{array}{c} 27 \\ 75 \\ 150 \end{array}$	$ \begin{array}{c c} 31.5 \\ 87.5 \\ 175.0 \end{array} $	$\begin{bmatrix} 36\\100\\200 \end{bmatrix}$	$\left \begin{array}{c} 40.5 \\ 112.5 \\ 225.0 \end{array}\right $
	4 5 6	$ \begin{array}{c c} 36.0 \\ 49.0 \\ 66.5 \end{array} $	$\begin{bmatrix} 72\\98\\133 \end{bmatrix}$	$ \begin{array}{ c c c c } \hline 108.0 \\ 147.0 \\ 199.5 \end{array} $	$egin{array}{c} 144 \ 196 \ 266 \ \end{array}$	$ \begin{array}{ c c c c } \hline 180.0 \\ 245.0 \\ 333.0 \end{array} $	$   \begin{array}{r}     216 \\     294 \\     399   \end{array} $	$\begin{array}{c c} 252.0 \\ 343.0 \\ 466.0 \end{array}$	288 393 832	$ \begin{array}{ c c c c c c } \hline & 324.0 \\ 441.0 \\ & 599.0 \\ \hline \end{array} $
22	1 2 3	$\begin{bmatrix} 5\\14\\29 \end{bmatrix}$	$\begin{array}{c c} 10 \\ 29 \\ 58 \end{array}$	$\begin{bmatrix} -15 \\ 43 \\ 87 \end{bmatrix}$	$\begin{bmatrix} 20\\58\\116 \end{bmatrix}$	$\begin{bmatrix} 25\\72\\145\end{bmatrix}$	$\begin{bmatrix} 30 \\ 87 \\ 174 \end{bmatrix}$	$\begin{bmatrix} 35\\101\\203\end{bmatrix}$	$egin{array}{c c} 40 \\ 116 \\ 232 \\ \end{array}$	$\left \begin{array}{c}45\\130\\261\end{array}\right $
	4 5 6	43 58 73	87 117 147 .	$egin{array}{c} 130 \\ 175 \\ 220 \\ \end{array}$	$egin{array}{c} 174 \\ 234 \\ 294 \\ \end{array}$	$egin{array}{c c} 218 \\ 293 \\ 367 \end{array}$	$egin{array}{c} 261 \\ 351 \\ 441 \\ \end{array}$	$\begin{vmatrix} 305 \\ 410 \\ 514 \end{vmatrix}$	$\begin{vmatrix} 348 \\ 468 \\ 588 \end{vmatrix}$	$\left  \begin{array}{c} 391 \\ 526 \\ 661 \end{array} \right $
24	2 3 4	$egin{array}{c c} 17 \\ 34 \\ 51 \\ \end{array}$	$\begin{array}{c} 35 \\ 68 \\ 103 \end{array}$	$\begin{array}{c c} 52 \\ 102 \\ 154 \end{array}$	$\begin{bmatrix} 70\\136\\206 \end{bmatrix}$	87 170 258	$egin{array}{c} 105 \\ 204 \\ 309 \\ \end{array}$	$egin{array}{c c} 122 \\ 238 \\ 360 \\ \end{array}$	$ \begin{array}{ c c c c } \hline 140 \\ 272 \\ 412 \\ \end{array} $	$\left  \begin{array}{c} 175 \\ 306 \\ 464 \end{array} \right $

## MULTIPLE VOLUME TABLE—BALSAM

DBH	Logs	1	2	3	4	5   5	6	7	8	9
26	5 6 2	70 87 19	$ \begin{array}{c c} 140 \\ 175 \\ 39 \end{array} $	$egin{array}{c} 210 \\ 263 \\ 58 \\ \hline \end{array}$	280 350 78	$\begin{vmatrix} 350 \\ 437 \\ 97 \end{vmatrix}$	$egin{array}{c c} 420 \\ 525 \\ 117 \end{array}$	$ \begin{array}{ c c c c } 490 \\ 612 \\ 136 \end{array} $	$ \begin{array}{ c c c } 560 \\ 700 \\ 156 \end{array} $	$\left \begin{array}{c} 630\\788\\175\end{array}\right $
	3 4 5	40 60 80	$ \begin{array}{ c c c }  & 80 \\  & 120 \\  & 160 \\ \end{array} $	$     \begin{array}{r}       120 \\       180 \\       240     \end{array} $	$\begin{array}{ c c c }\hline 160 \\ 240 \\ 320 \\ \end{array}$	200 300 400	$\begin{vmatrix} 240 \\ 360 \\ 480 \end{vmatrix}$	$oxed{ egin{array}{c} 280 \ 420 \ 560 \ \end{array} }$	320 480 640	$\left \begin{array}{c} 360 \\ 540 \\ 720 \end{array}\right $
	6 7 8	$102 \\ 124 \\ 143$	$   \begin{array}{c c}     204 \\     248 \\     287   \end{array} $	$egin{array}{c} 306 \\ 372 \\ 430 \\ \hline \end{array}$	408 496 573	$egin{array}{c} 510 \\ 620 \\ 716 \\ \end{array}$	$egin{array}{c} 612 \\ 744 \\ 860 \\ \end{array}$	$\begin{vmatrix} 714 \\ 868 \\ 1005 \end{vmatrix}$	$ \begin{array}{ c c c } 816 \\ 992 \\ 1150 \end{array} $	918 1116 1435
28	3 4 5	$\begin{array}{c} 46 \\ 69 \\ 94 \end{array}$	$\begin{array}{c} 92 \\ 139 \\ 188 \end{array}$	$   \begin{array}{c}     138 \\     208 \\     282   \end{array} $	$\begin{bmatrix} 184 \\ 278 \\ 376 \end{bmatrix}$	$     \begin{array}{r}       230 \\       348 \\       470     \end{array} $	$egin{array}{c} 276 \\ 417 \\ 564 \\ \hline \end{array}$	322 486 658	$   \begin{array}{r}     387 \\     586 \\     752   \end{array} $	414 625 845
	$\begin{bmatrix} 6 \\ 7 \\ 8 \end{bmatrix}$	$   \begin{array}{c}     118 \\     143 \\     168   \end{array} $	$   \begin{array}{r}     236 \\     286 \\     336   \end{array} $	$   \begin{array}{r}     354 \\     429 \\     504   \end{array} $	$egin{array}{c} 472 \\ 572 \\ 672 \\ \end{array}$	$   \begin{array}{r}     590 \\     715 \\     840   \end{array} $	$   \begin{array}{r}     708 \\     858 \\     1010   \end{array} $	$\begin{vmatrix} 825 \\ 1000 \\ 1175 \end{vmatrix}$	$\begin{vmatrix} 944 \\ 1145 \\ 1340 \end{vmatrix}$	$ \begin{array}{c c} 1060 \\ 1285 \\ 1510 \end{array} $
30	3 4 5	51 78 109	$\begin{bmatrix} 102 \\ 196 \\ 218 \end{bmatrix}$	$egin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{bmatrix} 204 \\ 314 \\ 436 \end{bmatrix}$	$   \begin{array}{c}     255 \\     392 \\     545   \end{array} $	$\begin{array}{c} 306 \\ 472 \\ 654 \end{array}$	$\begin{bmatrix} 357 \\ 550 \\ 763 \end{bmatrix}$	$   \begin{array}{r}     408 \\     628 \\     872   \end{array} $	$\begin{bmatrix} 459 \\ 706 \\ 981 \end{bmatrix}$
	6 7 8	$   \begin{array}{c c}     135 \\     165 \\     192   \end{array} $	270 330 385	$   \begin{array}{c c}     405 \\     495 \\     576   \end{array} $	$\begin{bmatrix} 540 \\ 660 \\ 770 \end{bmatrix}$	675 820 962	810 990 1155	$   \begin{vmatrix}     945 \\     1155 \\     1345   \end{vmatrix} $	$1080 \\ 1320 \\ 1540$	$\begin{bmatrix} 1215 \\ 1480 \\ 1730 \end{bmatrix}$

## MULTIPLE VOLUME TABLE—WESTERN RED CEDAR

(Based on 186 trees from District I. Diameters are D. I. B. at the top of the 1st log.) Constructed by the Frustum Form Factor Method.

Scribner Decimal C Rule.

D.I.B. Top1st		1	2	3	4	5	6	7	0	0
Log	Logs	1	2	v	4	J	U	•	8	9
Inches						2.5				
10	$\frac{1}{2}$	$5.0 \\ 8.5 \\ 12.5$	$egin{array}{c} 10.0 \ 17.0 \ 25.0 \ \end{array}$	$15.0 \\ 25.5 \\ 37.5$	$egin{array}{c} 20.0 \ 34.0 \ 50.0 \ \end{array}$	$egin{array}{c} 25.0 \ 42.5 \ 62.5 \end{array}$	$egin{array}{c} 30.0 \ 51.0 \ 75.0 \ \end{array}$	$   \begin{array}{r}     35.0 \\     59.5 \\     87.5   \end{array} $	$\begin{bmatrix} 40.0 \\ 68.0 \\ 100.0 \end{bmatrix}$	$begin{array}{c c} 45.0 & \\ 76.5 & \\ 112.5 & \\ \end{array}$
12	$\frac{1}{2}$	$\begin{array}{c} 8.5 \\ 11.5 \end{array}$	$\begin{bmatrix} 17.0 \\ 23.0 \end{bmatrix}$	$25.5 \\ 34.5$	$\begin{array}{c} 34.0 \\ 46.0 \end{array}$	$\frac{42.5}{57.5}$	$\begin{array}{c} 51.0 \\ 69.0 \end{array}$	$\begin{array}{c} 59.5 \\ 80.5 \end{array}$	$\begin{array}{c} 68.0 \\ 92.0 \end{array}$	$\begin{bmatrix} 76.5 \\ 103.5 \end{bmatrix}$
		16.5	33.0	49.5	66.0	82.5	99.0	115.5	132.0	148.5
14	$egin{pmatrix} rac{4}{1} \ 2 \end{bmatrix}$	$21.5 \\ 12.0 \\ 15.0$	$\begin{array}{c c} 43.0 \\ 24.0 \\ 30.0 \end{array}$	$ 54.0 \\ 36.0 \\ 45.0 $	$\begin{array}{c} 64.5 \\ 48.0 \\ 60.0 \end{array}$	$egin{array}{c} 107.5 \ 60.0 \ 75.0 \ \end{array}$	$egin{array}{c c} 129.0 \\ 72.0 \\ 90.0 \\ \end{array}$	$150.5 \\ 84.0 \\ 105.0$	$\begin{array}{c c} 172.0 \\ 96.0 \\ 120.0 \end{array}$	$\begin{array}{ c c c }\hline 193.5 \\ 108.0 \\ 135.0 \\ \hline \end{array}$
16	$\begin{bmatrix} 3\\4\\1 \end{bmatrix}$	$21.5 \\ 28.0 \\ 16.5$	$\begin{array}{c} 43.0 \\ 56.0 \\ 33.0 \end{array}$	$54.0 \\ 84.0 \\ 49.5$	$64.5 \\ 112.0 \\ 66.0$	$\begin{array}{c c} 107.5 \\ 140.0 \\ 82.5 \end{array}$	$\begin{bmatrix} 129.0 \\ 168.0 \\ 99.0 \end{bmatrix}$	$egin{array}{c} 150.5 \ 196.0 \ 115.5 \ \end{array}$	$\begin{array}{c c} 172.0 \\ 224.0 \\ 132.0 \end{array}$	$ \begin{array}{c c} 193.5 \\ 252.0 \\ 148.5 \end{array} $
	$\frac{2}{3}$	$egin{array}{c} 20.0 \ 26.5 \ 36.5 \ \end{array}$	$\begin{array}{c} 40.0 \\ 52.0 \\ 73.0 \end{array}$	$60.0 \\ 79.5 \\ 109.5$	$\begin{bmatrix} 80.0 \\ 106.0 \\ 146.0 \end{bmatrix}$	$\begin{array}{c} 100.0 \\ 132.5 \\ 182.5 \end{array}$	$\begin{bmatrix} 120.0 \\ 159.0 \\ 219.0 \end{bmatrix}$	$\begin{array}{ c c c }\hline 140.0 \\ 185.0 \\ 255.0 \\ \end{array}$	$\begin{array}{ c c c }\hline 160.0 \\ 212.0 \\ 292.0 \\\hline \end{array}$	$ \begin{array}{ c c c c } \hline 180.0 \\ 238.0 \\ 328.0 \end{array} $
18	$\begin{array}{c} 5 \\ 1 \\ 2 \end{array}$	$\begin{array}{c c} 45.0 \\ 22.5 \\ 25.5 \end{array}$	$90.0 \\ 45.0 \\ 51.0$	$135.0 \\ 67.5 \\ 76.5$	$egin{array}{c} 180.0 \\ 90.0 \\ 102.0 \\ \end{array}$	$egin{array}{c c} 225.0 \\ 112.5 \\ 127.5 \\ \end{array}$	$egin{array}{c} 270.0 \ 135.0 \ 153.0 \ \end{array}$	$\begin{array}{c c} 315.0 \\ 157.5 \\ 178.5 \end{array}$	$\begin{array}{ c c c c }\hline 360.0 \\ 180.0 \\ 204.0 \\ \hline \end{array}$	$\begin{array}{ c c c }\hline 405.0 \\ 202.5 \\ 229.0 \\ \hline \end{array}$
,	3 4 5	$ \begin{array}{c c} 35.5 \\ 46.5 \\ 57.0 \end{array} $	$egin{array}{c} 71.0 \ 93.0 \ 114.0 \ \end{array}$	$106.5 \\ 139.5 \\ 171.0$	$\begin{array}{ c c c }\hline 142.0 \\ 186.0 \\ 228.0 \\\hline \end{array}$	$egin{array}{c c} 177.5 \\ 232.0 \\ 285.0 \\ \end{array}$	$\begin{array}{ c c c }\hline 213.0 \\ 279.0 \\ 342.0 \\\hline \end{array}$	$\begin{array}{c c} 248.0 \\ 326.0 \\ 399.0 \end{array}$	$\begin{bmatrix} 284.0 \\ 372.0 \\ 456.0 \end{bmatrix}$	$\left \begin{array}{c} 320.0 \\ 419.0 \\ 513.0 \end{array}\right $
20	$\begin{array}{c} 6 \\ 1 \\ 2 \end{array}$	$\begin{array}{c c} 67.5 \\ 29.0 \\ 31.5 \end{array}$	$\begin{array}{c c} 135.0 \\ 58.0 \\ 63.0 \end{array}$	$\begin{array}{c c} 202.0 \\ 87.0 \\ 94.5 \end{array}$	$egin{array}{c} 270.0 \ 116.0 \ 126.0 \ \end{array}$	538.0 145.0 157.5	$\begin{bmatrix} 405.0 \\ 174.0 \\ 189.0 \end{bmatrix}$	$\begin{array}{ c c c c }\hline 472.0 \\ 203.0 \\ 220.0 \\ \hline \end{array}$	$\begin{bmatrix} 540.0 \\ 232.0 \\ 252.0 \end{bmatrix}$	$\begin{bmatrix} 607.0 \\ 261.0 \\ 283.0 \end{bmatrix}$
_	2 3 4 5	$\begin{array}{c c} 44.5 \\ 57.5 \\ 70.5 \end{array}$	$\begin{array}{c} 89.0 \\ 115.0 \\ 141.0 \end{array}$	$\begin{array}{c c} 133.5 \\ 172.5 \\ 211.0 \end{array}$	$\begin{array}{c c} 178.0 \\ 230.0 \\ 282.0 \end{array}$	$\begin{bmatrix} 222.0 \\ 288.0 \\ 352.0 \end{bmatrix}$	$\begin{array}{ c c c c }\hline 267.0 \\ 345.0 \\ 423.0 \\ \hline \end{array}$	$\begin{bmatrix} 311.0 \\ 403.0 \\ 494.0 \end{bmatrix}$	$\begin{array}{c c} 356.0 \\ 460.0 \\ 564.0 \end{array}$	$\begin{bmatrix} 400.00 \\ 518.0 \\ 635.0 \end{bmatrix}$
22	$\begin{bmatrix} & 6 \\ 7 \\ 1 \end{bmatrix}$	$ \begin{array}{c c} 84.5 \\ 96.5 \\ 35 \end{array} $	$\begin{array}{ c c c c }\hline 169.0 \\ 193.0 \\ 70 \\ \end{array}$	$egin{array}{c} 254.0 \ 290.0 \ 105 \ \end{array}$	$\begin{array}{c c} 338.0 \\ 386.0 \\ 140 \end{array}$	$oxed{423.0} \ 483.0 \ 175$	$\begin{bmatrix} 506.0 \\ 580.0 \\ 210 \end{bmatrix}$	$\begin{bmatrix} 590.0 \\ 675.0 \\ 245 \end{bmatrix}$	$\begin{bmatrix} 675.0 \\ 772.0 \\ 280 \end{bmatrix}$	$ \begin{array}{ c c c c c } \hline 706.0 \\ 870.0 \\ 315 \\ \hline \end{array} $
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	38 53 68	$egin{array}{c c} 77 \\ 107 \\ 137 \\ \end{array}$	$egin{array}{c} 115 \\ 160 \\ 205 \\ \end{array}$	$egin{array}{c c} 154 \\ 214 \\ 274 \\ \end{array}$	$egin{array}{c} 192 \ 267 \ 343 \ \end{array}$	$egin{array}{c} 231 \\ 321 \\ 411 \\ \end{array}$	$oxed{269} \ 375 \ 480$	308 428 548	$\begin{bmatrix} 346 \\ 482 \\ 616 \end{bmatrix}$
	5 6 7	$egin{array}{c} 84 \\ 104 \\ 117 \\ \end{array}$	$egin{array}{c} 169 \\ 208 \\ 234 \\ \end{array}$	$egin{array}{c} 254 \\ 312 \\ 351 \\ \end{array}$	338 416 468	$egin{array}{c} 423 \\ 520 \\ 585 \\ \end{array}$	$\begin{bmatrix} 506 \\ 624 \\ 702 \end{bmatrix}$	$egin{array}{c c} 591 \\ 728 \\ 819 \\ \end{array}$	676 832 936	$\begin{bmatrix} 760 \\ 936 \\ 1053 \end{bmatrix}$
24	$\begin{vmatrix} 1 \\ 2 \\ 3 \end{vmatrix}$	$\begin{vmatrix} 42\\46\\62\end{vmatrix}$	$\begin{array}{ c c c }\hline & 254 \\ \hline & 85 \\ & 92 \\ \hline & 125 \\ \end{array}$	$egin{array}{c} 331 \\ 127 \\ 138 \\ 187 \\ \end{array}$	$egin{array}{ c c c c c c c c c c c c c c c c c c c$	$egin{array}{c c} 212 \\ 230 \\ 312 \\ \end{array}$	$egin{array}{c c} 255 \\ 276 \\ 375 \\ \end{array}$	$egin{array}{c c} 313 \\ 297 \\ 322 \\ 437 \\ \end{array}$	$     \begin{array}{r}                                     $	$egin{array}{ c c c c c c c c c c c c c c c c c c c$
	4 5	81 101	$\begin{array}{ c c c }\hline 163 \\ 202 \\ \end{array}$	245 303	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	407   505	489 606	570	652 808	734 909
	6	120	240	360	480	600	720	840	960	1080

## MULTIPLE VOLUME TABLE-WESTERN RED CEDAR

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{bmatrix} 1240 \\ 1410 \\ 472 \\ 504 \\ 685 \\ 887 \\ 1080 \\ 1278 \\ 1485 \end{bmatrix}$
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1240 1410 472 504 685 887 1080 1278
$\begin{array}{c c ccccccccccccccccccccccccccccccccc$	$ \begin{vmatrix} 1410 \\ 472 \\ 504 \\ 685 \\ 887 \\ 1080 \\ 1278 \end{vmatrix} $
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c} & 472 &   \\ & 504 &   \\ & 685 &   \\ & 887 &   \\ & 1080 &   \\ & 1278 &   \end{array}$
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	504 685 887 1080 1278
3   76   152   228   304   380   456   533   608	685 887 1080 1278
	$ \begin{array}{ c c c c c } \hline  & 887 \\  & 1080 \\  & 1278 \\ \hline \end{array} $
4   30   191   290   394   493   592   690   789	$\begin{vmatrix} 1080 \\ 1278 \end{vmatrix}$
5   120   240   360   480   600   720   840   960	1278
$\begin{bmatrix} 3 & 120 & 240 & 360 & 480 & 600 & 720 & 840 & 360 \\ 6 & 142 & 284 & 426 & 568 & 710 & 852 & 994 & 1136 \end{bmatrix}$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	[ 7 (3 +)
8   187   374   560   748   935   1120   1310   1495	1680
9   210   420   630   840   1050   1260   1470   1680	1890
28   1   61   122   183   244   305   366   427   488	549
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	585
	792
4   116   232   348   464   580   696   812   928	1044
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{vmatrix} 1205 \\ 1490 \end{vmatrix}$
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	1730
8   217   434   650   868   1085   1300   1520   1735	1950
9   245   490   735   980   1220   1470   1715   1960	2020
10   270   540   810   1080   1350   1620   1890   2160	2430
30   1   69   138   207   276   345   414   483   552	621
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	957
3 98 197 296 394 493 592 690 789	887
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{vmatrix} 1160 \\ 1430 \end{vmatrix}$
$\begin{bmatrix} 5 & 139 & 318 & 477 & 636 & 793 & 934 & 1110 & 1270 \\ 6 & 189 & 379 & 568 & 758 & 947 & 1140 & 1330 & 1515 \end{bmatrix}$	1705
7   222   444   666   888   1110   1330   1550   1775	1995
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	2260
9   278   556   835   1110   1390   1665   1945   2220	2500
10   311   622   933   1244   1555   1866   2177   2488	2799
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	697
	734
$oxed{3} oxed{113} oxed{226} oxed{339} oxed{452} oxed{565} oxed{678} oxed{791} oxed{904} \\ oxed{1175}$	1017
$\left  egin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{vmatrix} 1320 \\ 1640 \end{vmatrix}$
6   205   410   615   820   1025   1230   1435   1640	1845
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2240
8   282   564   845   1130   1410   1690   1975   2260	2540
9   318   636   594   1275   1590   1910   2225   2550	2860
$oxed{10} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	3170
34         1         84         168         252         336         420         504         589         672	756
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	792
$egin{array}{ c c c c c c c c c c c c c c c c c c c$	984
$\begin{bmatrix} 4 & 102 & 324 & 486 & 648 & 816 & 372 & 1133 & 1236 \\ 5 & 199 & 398 & 597 & 796 & 995 & 11194 & 1393 & 1592 \end{bmatrix}$	11790
$\begin{bmatrix} 5 & 133 & 338 & 337 & 136 & 333 & 1134 & 1333 & 1332 \\ 6 & 239 & 478 & 717 & 956 & 1195 & 1435 & 1673 & 1912 \end{bmatrix}$	2152
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2500
8   318   636   954   1272   1590   1910   2225   2545	2860
9   357   714   1070   1430   1785   2140   2500   2860	3210
	13735

## MULTIPLE VOLUME TABLE—WESTERN RED CEDAR

(Based on 186 trees from District I. Diameters are DBH.) Constructed by deriving volumes from DIB (top 1st log) volume curves.

Scribner Decimal C. Rule.

DBH	Logs	1	2	3	4	5	6	7	8	9
Inches										
10	1	3.0	6.0	[9.0]	$\begin{bmatrix} 12.0 \end{bmatrix}$	15.0	18.0	21.0	24.0	27.0
	$\begin{bmatrix} 2 \\ 3 \end{bmatrix}$	6.5	13	$\frac{19.5}{27}$	$\frac{26}{26}$	$\frac{32.5}{15}$	39	45.5	52	58.5
		- 9	18	27	$\begin{bmatrix} -36 \\ -48 \end{bmatrix}$	45	$-\frac{54}{60}$	63	$\begin{bmatrix} -72 \\ -24 \end{bmatrix}$	81
12	4 1	$\begin{array}{c} 10.5 \\ 5 \end{array}$	$egin{bmatrix} -21 \ 10 \end{matrix}$	$\begin{array}{c c} 31.5 \\ 15 \end{array}$	$\begin{bmatrix} 42\\20 \end{bmatrix}$	$\left[egin{array}{c} 5\overline{2}.5 \ 25 \end{array} ight]$	$\begin{bmatrix} 63 \\ 30 \end{bmatrix}$	$\begin{array}{c} 73.5 \\ 35 \end{array}$	84	$\begin{array}{ c c c }\hline 94.5\\ 45 \end{array}$
14	$\frac{1}{2}$	8	16	$\begin{array}{c c} 13 \\ 24 \end{array}$	$\frac{20}{32}$	$\begin{vmatrix} 23 \\ 40 \end{vmatrix}$	48	$\frac{56}{56}$	64	72
	$-\frac{2}{3}$	$-\frac{3}{11.5}$	$\frac{1}{23}$	$\frac{1}{34.5}$	46	57.5	69	80.5	$\frac{1}{92}$	103.5
	$\frac{3}{4}$	$1\overline{5}$	$\frac{20}{30}$	45	$\hat{60}$	75	90	105	$1\overline{20}$	135
14	1	7.5	15	22.5	30	37.5	45	52.5	60	67.5
ĺ	2	10.5	21	31.5	42	52.5	63	73.5	84	94.5
	3	15	3.0	45	60	75	90	105	120	135
	4	21	42	63	84	105	126	147	168	189
16	1	10	20	30	40	50	60	70	80	90
	$\begin{bmatrix} 2 \\ 3 \end{bmatrix}$	13.5	$\frac{27}{27}$	40.5	54	67.5	81	94.5	108	121.5
		$\frac{18.5}{25}$	37	$\begin{bmatrix} 55.5 \\ 75 \end{bmatrix}$	$\begin{bmatrix} 74 \\ 100 \end{bmatrix}$	$\begin{array}{ c c c c c c }\hline 92.5 \\ \hline \end{array}$	$\begin{array}{c} 111 \\ 150 \end{array}$	129.5	148	166.5
	5	$\begin{array}{c} 25 \\ 31.5 \end{array}$	$\begin{array}{c} 50 \\ 63 \end{array}$	94.5	126	$\begin{bmatrix} 125 \\ 157.5 \end{bmatrix}$	189	$\begin{array}{c} 175 \\ 220 \end{array}$	$\begin{array}{c} 200 \\ 252 \end{array}$	$\begin{bmatrix} 225 \\ 284 \end{bmatrix}$
18	1	13	$\frac{03}{26}$	39	$\frac{120}{52}$	65	78	91	104	117
-	2	16.5	33	$\frac{-49.5}{}$	66	82.5	99	115.5	$1\overline{32}$	148.5
1	$\bar{3}$	$\frac{23}{23}$	46	69	$9\overline{2}$	115	138	161	184	207
Ì	4	30	60	90	120	150	180	210	240	270
	5	37.5	75	$112.\overline{5}$	150	187.5	225	262	300	337
20	1	16	$\frac{32}{2}$	48	$\frac{64}{5}$	80	96	112	128	144
,	2	19	39	57	76	95	114	133	152	171
	3	26.5	53	79.5	106	132.5	159	185	212	238
	5	$\begin{array}{c} 35 \\ 44 \end{array}$	70 88	$\begin{array}{c} 105 \\ 132 \end{array}$	$\begin{array}{c} 140 \\ 176 \end{array}$	$\begin{bmatrix} 175 \\ 220 \end{bmatrix}$	$\begin{array}{c} 210 \\ 264 \end{array}$	$\begin{array}{c} 245 \\ 308 \end{array}$	$\begin{bmatrix} 280 \\ 352 \end{bmatrix}$	$\begin{bmatrix} 315 \\ 396 \end{bmatrix}$
22	1	19	39	58	$\frac{178}{78}$	$\frac{220}{97}$	$\frac{204}{117}$	136	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
24	$\frac{1}{2}$	$\frac{1}{2}\frac{3}{2}$	$\frac{35}{45}$	67	90	112	135	157	180	$\begin{bmatrix} 113 \\ 202 \end{bmatrix}$
	$\begin{bmatrix} 2 \\ 3 \end{bmatrix}$	$\overline{31}$	63	$9\dot{4}$	$1\overline{26}$	157	189	220	252	284
	4	41	82	$1\overline{23}$	164	-205	$2\overline{46}$	287	328	369
	5	51	103	154	206	258	309	361	413	464
24	1	22	45	67	90	112	135	157	180	202
	2	26	52	78	104	130	156	182	208	234
	3	36	72	108	144	180	216	252	288	$\begin{vmatrix} 324 \\ 418 \end{vmatrix}$
	4	$\frac{46}{50}$	93	139	-186	232	279	$\frac{326}{410}$	372	
	$\begin{bmatrix} 5 \\ 6 \end{bmatrix}$	58 70	$\begin{array}{c c} 117 \\ 140 \end{array}$	$\begin{bmatrix} 175 \\ 210 \end{bmatrix}$	$\begin{array}{c} 234 \\ 280 \end{array}$	$\begin{bmatrix} 292 \\ 350 \end{bmatrix}$	$\begin{array}{c} 351 \\ 420 \end{array}$	410 490	$\begin{array}{c} 468 \\ 560 \end{array}$	$\begin{bmatrix} 526 \\ 630 \end{bmatrix}$
26	1	$\frac{70}{26}$	53	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	106	132	159	185	212	238
₩ U	$\frac{1}{2}$	$\frac{20}{29}$	59	88	118	147	177	$\frac{100}{206}$	$\frac{236}{236}$	266
	$\frac{2}{3}$	$\frac{20}{40}$	81	121	162	$\begin{bmatrix} 141 \\ 202 \end{bmatrix}$	$\frac{1}{2}$ 43	284	$\frac{230}{324}$	364
	4	$\tilde{53}$	$1\overline{06}$	159	$2\overline{12}$	$\overline{265}$	318	371	424	477
	5	66	132	198	264	330	396	462	528	594
	6	79	158	237	316	395	474	554	632	711
	7	92	184	276	368	460	552	644	736	829
28	1	30	60	90	120	150	180	210	240	270
	2	33	66	99	132	$\begin{vmatrix} 165 \\ 229 \end{vmatrix}$	$\begin{array}{c} 198 \\ 273 \end{array}$	$\begin{array}{c} 231 \\ 318 \end{array}$	$\begin{array}{c} 264 \\ 364 \end{array}$	$\begin{bmatrix} 297 \\ 410 \end{bmatrix}$
	$\frac{3}{4}$	$\frac{45}{59}$	91	$\begin{array}{ c c c c c }\hline 136 \\ \hline 177 \\ \hline \end{array}$	$\begin{array}{c} 182 \\ 236 \end{array}$	$\begin{bmatrix} 228 \\ 295 \end{bmatrix}$	$\frac{2}{354}$	$\frac{318}{413}$	472	531
	5	$\frac{59}{73}$	$\begin{array}{c} 118 \\ 147 \end{array}$	$\begin{bmatrix} 177 \\ 220 \end{bmatrix}$	$\begin{bmatrix} 236 \\ 294 \end{bmatrix}$	$oxed{368}$	441	515	588	$\begin{vmatrix} 661 \end{vmatrix}$
	$\frac{5}{6}$	87	175	$\begin{array}{c} 220 \\ 262 \end{array}$	350	$\begin{bmatrix} 303 & 1 \\ 437 & 1 \end{bmatrix}$	525	613	700	788

## MULTIPLE VOLUME TABLE—WESTERN RED CEDAR

			1	1	1	_	1	1	1	1
DBH	Logs	1	$\begin{bmatrix} & 2 & 1 \\ 1 & & 1 \end{bmatrix}$	3	4	5	6	7	8	9
	7	101	203	304	406	507	609	710	812	913
3.0	1	3.3	66	99	132	165	198	231	264	297
	2	36	73	109	146	182	21.9	256	292	328
	3	50	100	150	200	250	300	350	400	450
	4	65	130	195	260	325	390	455	520	585
_	5	80	161	242	322	403	483	564	644	725
	$\frac{6}{7}$	$\begin{array}{c} 95 \\ 111 \end{array}$	$\begin{array}{ c c c c }\hline 191 \\ 222 \\ \end{array}$	$\begin{array}{ c c c c }\hline 286 \\ 333 \\ \end{array}$	382	478 555	573	669	764	860
32	í	37	75	112	150	187	225	262	888	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
		41	$\frac{1}{1} - \frac{10}{82}$	$\frac{1}{1}$	164	205	246	287	328	369
	$\tilde{3}$	$5\overline{6}$	112	168	224	280	336	392	448	504
	4	72	145	217	290	362	435	508	580	653
a	5	90	180	$\overline{270}$	360	450	540	630	720	810
	6	106	213	320	426	532	640	745	852	960
	7	124	248	372	496	620	744	868	992	1116
34	1	41	83	124	166	208	249	291	332	374
	$\frac{2}{3}$	45	90	135	180	225	270	315	360	405
		61	123	184	246	307	369	431	492	554
	4	80	160	240	320	100	480	560	640	720
	5 6	$\begin{bmatrix} 99\\117 \end{bmatrix}$	$\begin{array}{ c c c c }\hline 198 \\ 234 \\ \end{array}$	$\begin{array}{ c c c c c }\hline 297\\351\end{array}$	$\begin{array}{ c c c c c c }\hline 396 \\ 469 \\ \hline \end{array}$	495   585	$\begin{array}{ c c c }\hline 594\\ 702 \end{array}$	$\begin{array}{ c c c c }\hline 693 \\ 820 \\ \end{array}$	$\begin{array}{c c} 792 \\ 936 \end{array}$	891
		136	272	1 408	544	680	816	953	$\frac{1090}{1090}$	$\begin{vmatrix} 1035 \\ 1225 \end{vmatrix}$
	8	155	310	465	620	775	930	1085	$\begin{vmatrix} 1030 \\ 1240 \end{vmatrix}$	$\begin{vmatrix} 1223 \\ 1390 \end{vmatrix}$
3.6	1	46	92	138	184	230	276	322	368	414
_	2	49	99	148	198	247	297	346	396	1 446
	$\frac{2}{3}$	67	134	200	268	335	400	469	536	600
	4	87	175	262	350	437	525	613	700	788
	5	108	217	326	434	543	651	760	869	978
	6	127	255	382	510	638	765	893	1020	1148
	7	149	298	447	$\frac{ 596}{ 596}$	745	895	1042	1190	1340
20	8	169	338	506	676	845	1015	11185	1351	1520
38	2 3	5 4 7 4	109	$\begin{array}{ c c c c }\hline 163 \\ 222 \\ \end{array}$	$\begin{array}{ c c c c c }\hline 218 \\ 296 \\ \hline \end{array}$	272   370	$\begin{bmatrix} 327 \\ 444 \end{bmatrix}$	382   518	$\begin{array}{ c c c }\hline 436\\ 592\\ \hline\end{array}$	$\left \begin{array}{c} 490 \\ 666 \end{array}\right $
-	4	$\frac{1}{96}$	193	290	386	1 483	579	$\frac{1}{676}$	$\frac{1}{772}$	870
	5	119	$\begin{vmatrix} 133 \\ 238 \end{vmatrix}$	$\begin{vmatrix} 250 \\ 357 \end{vmatrix}$	476	595	714	833	$95\overline{2}$	1071
	6	140	280	420	560	700	840	980	1120	1400
	7	163	326	490	653	815	980	1140	1305	11465
	8	186	372	558	744	930	1115	1300	1440	1675
	9	210	420	630	840	1050	1260	1470	1680	1890
40	2	58	117	176	234	292	351	410	468	526
	3	79	159	238	318	397	477	556	636	716
	4	104	208	312	416	520	624	728	832	936
	5	128	256	384	512	640	758	896	1025	1150
	$\frac{6}{7}$	$\begin{array}{c c} 150 \\ 176 \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c }\hline 450\\ 528\\ \end{array}$	$\begin{vmatrix} 600 \\ 704 \end{vmatrix}$	750   880	$\begin{array}{c}   900 \\   1055 \end{array}$	$\begin{vmatrix} 1050 \\ 1230 \end{vmatrix}$	$\begin{vmatrix} 1200 \\ 1410 \end{vmatrix}$	$\begin{vmatrix} 1350 \\ 1585 \end{vmatrix}$
	8	201	402	603	804	1005	1206	11407	1608	1809
	9	$\begin{vmatrix} 201\\226\end{vmatrix}$	452	678	904	1130	1355	1580	1810	2040
42	3	86	172	258	344	430	516	602	688	774
	4	112	225	338	450	563	675	788	900	1015
	5	139	277	416	554	693	830	970	1110	1245
	6	162	324	486	648	810	972	1135	1295	1460
	7	190	380	570	760	950	1140	1330	1520	1710
	8	218	435	653	870	1090	1305	1520	1740	1960
	9	244	488	732	976	1220	1460	1710	1950	2200

## MULTIPLE VOLUME TABLE-WESTERN RED CEDAR

DBH	Logs	1	2	3	4	5	6	7	8	9	
44	$\begin{bmatrix} 1.0 \\ 3 \\ 4 \end{bmatrix}$	$\begin{bmatrix} 269 \\ 94 \\ 122 \end{bmatrix}$	$\begin{bmatrix} 538 \\ 187 \\ 244 \end{bmatrix}$	807 280 366	1075 374 488	$\begin{vmatrix} 1345 \\ 467 \\ 610 \end{vmatrix}$	$egin{array}{c} 1615 \\ 561 \\ 732 \\ \hline \end{array}$	$\begin{vmatrix} 1880 \\ 655 \\ 854 \end{vmatrix}$	$\begin{vmatrix} 2150 \\ 748 \\ 976 \end{vmatrix}$	$\begin{vmatrix} 2420 \\ 841 \\ 1100 \end{vmatrix}$	[
_	5 6 7	$egin{array}{c} 150 \\ 176 \\ 206 \\ \end{array}$	$\begin{vmatrix} 300 \\ 351 \\ 412 \end{vmatrix}$	$oxed{450}{527}{618}$	$egin{array}{c} 600 \\ 702 \\ 824 \\ \end{array}$	$\begin{bmatrix} 750 \\ 878 \\ 1030 \end{bmatrix}$	$\begin{bmatrix} 900 \\ 1052 \\ 1236 \end{bmatrix}$	$\begin{bmatrix} 1050 \\ 1230 \\ 1442 \end{bmatrix}$	$\begin{bmatrix} 1200 \\ 1400 \\ 1648 \end{bmatrix}$	$1350 \\ 1580 \\ 1854$	
	$\begin{bmatrix} 8\\9\\10 \end{bmatrix}$	$\begin{array}{ c c c }\hline 235\\ 265\\ 291\\\hline\end{array}$	$\begin{vmatrix} 471 \\ 530 \\ 583 \end{vmatrix}$	$\begin{bmatrix} 706 \\ 794 \\ 874 \end{bmatrix}$	$\begin{vmatrix} 942 \\ 1060 \\ 1160 \end{vmatrix}$	$egin{array}{c} 1178 \\ 1320 \\ 1450 \\ \end{array}$	$\begin{vmatrix} 1412 \\ 1590 \\ 1745 \end{vmatrix}$	$\begin{vmatrix} 1650 \\ 1850 \\ 2040 \end{vmatrix}$	$egin{array}{c} 1885 \ 2120 \ 2330 \ \end{array}$	$\begin{bmatrix} 2120 \\ 2380 \\ 2620 \end{bmatrix}$	
46	3 4 5	$egin{array}{c c} 100 \\ 131 \\ 161 \\ \end{array}$	$egin{array}{c} 201 \\ 262 \\ 322 \\ \end{array}$	$\begin{bmatrix} 302 \\ 393 \\ 483 \end{bmatrix}$	402 524 645	503   655   805	$ \begin{vmatrix} 603 \\ 785 \\ 966 \end{vmatrix} $	$egin{array}{c} 704 \\ 917 \\ 1130 \\ \end{array}$	$\begin{bmatrix} 804 \\ 1050 \\ 1290 \end{bmatrix}$	$\begin{vmatrix} 905 \\ 1180 \\ 1450 \end{vmatrix}$	
	6 7 8	$egin{array}{c} 188 \\ 222 \\ 253 \\ \end{array}$	376 444 506	564 666 760	$\begin{vmatrix} 752 \\ 888 \\ 1010 \end{vmatrix}$	$egin{array}{c} 940 \\ 1110 \\ 1265 \\ \end{array}$	$\begin{bmatrix} 1130 \\ 1330 \\ 1520 \end{bmatrix}$	$\begin{vmatrix} 1315 \\ 1550 \\ 1770 \end{vmatrix}$	$\begin{vmatrix} 1500 \\ 1775 \\ 2020 \end{vmatrix}$	$\begin{bmatrix} 1690 \\ 2000 \\ 2280 \end{bmatrix}$	
48	$\begin{bmatrix} 9\\10\\3 \end{bmatrix}$	284 315 118	$ \begin{array}{ c c c c c } 568 \\ 630 \\ 236 \end{array} $	850 945 354	$\begin{vmatrix} 1135 \\ 1260 \\ 472 \end{vmatrix}$	$\begin{vmatrix} 1420 \\ 1575 \\ 590 \end{vmatrix}$	$\begin{vmatrix} 1700 \\ 1890 \\ 710 \end{vmatrix}$	$\begin{bmatrix} 1990 \\ 2200 \\ 826 \end{bmatrix}$	$\begin{bmatrix} 2270 \\ 2520 \\ 945 \end{bmatrix}$	$egin{array}{c} 2560 \\ 2840 \\ 1060 \\ \hline \end{array}$	
	4 5 6	$egin{array}{c c} 140 \\ 172 \\ 202 \\ \end{array}$	$\begin{bmatrix} 280 \\ 344 \\ 404 \end{bmatrix}$	$\begin{bmatrix} 420 \\ 516 \\ 606 \end{bmatrix}$	$\begin{vmatrix} 560 \\ 678 \\ 808 \end{vmatrix}$	$egin{array}{c c} 700 \\ 860 \\ 1010 \\ \hline \end{array}$	$egin{array}{c}   ~840 \\   1030 \\   1212 \\ \hline \end{array}$	$\begin{vmatrix} 980 \\ 1205 \\ 1404 \end{vmatrix}$	$\begin{vmatrix} 1120 \\ 1375 \\ 1616 \end{vmatrix}$	$\begin{vmatrix} 1260 \\ 1550 \\ 1818 \end{vmatrix}$	
	$\begin{bmatrix} 7\\8\\9 \end{bmatrix}$	$egin{array}{c} 237 \\ 271 \\ 305 \\ \hline \end{array}$	$\begin{array}{ c c }\hline 474\\542\\610\\\hline\end{array}$	$egin{array}{c} 711 \ 823 \ 915 \ \end{array}$	$\begin{vmatrix} 948 \\ 1080 \\ 1220 \end{vmatrix}$	$egin{array}{c} 1185 \ 1355 \ \hline 1525 \ \end{array}$	$egin{array}{c}  1420 \\  1625 \\  1830 \\ \hline \end{array}$	$\begin{bmatrix} 1660 \\ 1895 \\ 2135 \end{bmatrix}$	$\begin{vmatrix} 1895 \\ 2170 \\ 2440 \end{vmatrix}$	$egin{array}{c} 2130 \\ 2440 \\ 2745 \\ \hline \end{array}$	
5 0	1045	$\begin{vmatrix} 341 \\ 148 \\ 181 \end{vmatrix}$	$egin{array}{c} 682 \\ 296 \\ 363 \\ \end{array}$	$   \begin{vmatrix}     1020 \\     444 \\     544   \end{vmatrix} $	$egin{array}{c} 1360 \\ 592 \\ 726 \\ \end{array}$	$  1700 \\   740 \\   908$	$egin{array}{c} 2025 \ 888 \ 1090 \ \end{array}$	$egin{array}{c} 2385 \ 1040 \ 1270 \ \end{array}$	$\begin{vmatrix} 2730 \\ 1185 \\ 1450 \end{vmatrix}$	$\begin{vmatrix} 3070 \\ 1330 \\ 1630 \end{vmatrix}$	
	6 7 8	$\begin{bmatrix} 215\\251\\288\end{bmatrix}$	$\left \begin{array}{c}430\\502\\575\end{array}\right $	$  \begin{array}{c} 645 \\ 753 \\ 863 \end{array}  $	$\begin{vmatrix} 860 \\ 1004 \\ 1150 \end{vmatrix}$	$egin{array}{c}  1075 \\  1255 \\  1435 \\ \end{array}$	$ 1\overline{290}  \\  1506  \\  1725 $	$\begin{vmatrix} 1505 \\ 1757 \\ 2005 \end{vmatrix}$	$\begin{vmatrix} 1720 \\ 2008 \\ 2300 \end{vmatrix}$	$     \begin{array}{r}       1935 \\       2259 \\       2590     \end{array} $	
52	$\begin{bmatrix} 9\\10\\4 \end{bmatrix}$	$\begin{vmatrix} 322 \\ 368 \\ 155 \end{vmatrix}$	$egin{array}{c c} 644 \\ 736 \\ 311 \\ \hline \end{array}$	$\begin{vmatrix} 966 \\ 1105 \\ 389 \end{vmatrix}$	$\begin{vmatrix} 1290 \\ 1470 \\ 467 \end{vmatrix}$	$\begin{bmatrix} 1610 \\ 1840 \\ 622 \end{bmatrix}$	$\begin{vmatrix} 1930 \\ 2210 \\ 778 \end{vmatrix}$	$ 2260 \\  2580 \\  1009$	$\begin{vmatrix} 2580 \\ 2940 \\ 1245 \end{vmatrix}$	$egin{array}{c} 2900 \ 3310 \ 1400 \ \end{array}$	
	$\begin{array}{ c c c }\hline 5\\ 6\\ 7\\ \end{array}$	$egin{array}{c c} 191 \\ 228 \\ 264 \\ \end{array}$	$\begin{vmatrix} 381 \\ 455 \\ 528 \end{vmatrix}$	$\begin{bmatrix} 572 \\ 684 \\ 792 \end{bmatrix}$	$\begin{vmatrix} 763 \\ 910 \\ 1055 \end{vmatrix}$	$  953 \\   1140 \\   1320$	$ 1140 \\  1365 \\  1585$	$\begin{vmatrix} 1335 \\ 1590 \\ 1850 \end{vmatrix}$	$\begin{vmatrix} 1525 \\ 1820 \\ 2110 \end{vmatrix}$	$\begin{bmatrix} 1905 \\ 2050 \\ 2380 \end{bmatrix}$	
	$\begin{array}{c c} 8 \\ 9 \\ 10 \end{array}$	$\begin{bmatrix} 3\overline{0}4\\ 342\\ 396 \end{bmatrix}$	$\begin{bmatrix} 607 \\ 685 \\ 792 \end{bmatrix}$	$\begin{vmatrix} 910 \\ 1025 \\ 1190 \end{vmatrix}$	$\begin{array}{c}  1210 \\  1370 \\  1585 \end{array}$	$egin{array}{c}  1515 \\  1710 \\  1980 \\ \end{array}$	$egin{array}{c} 1820 \\ 2050 \\ 2380 \\ \end{array}$	$egin{array}{c} 2120 \ 2400 \ 2770 \ \end{array}$	$\begin{vmatrix} 2430 \\ 2740 \\ 3170 \end{vmatrix}$	$egin{array}{c} 2730 \ 3080 \ 3560 \ \hline \end{array}$	

## MULTIPLE VOLUME TABLE—LODGE POLE PINE

(NOTE—Trees 10 inches and up over two logs, based on 1808 trees in Gallatin County. Other measurements taken in Deer Lodge County, Montana.)
No. of Trees.

DBH	Logs	1	2	3	4	5	6	7	8	9
				9						
. 7 8	$egin{array}{cccc} 1 & 1 & 1 \\ & 1 & \end{array}$	$oxed{1}{2}$	$\frac{2}{4}$	$\frac{3}{6}$	8	$\begin{bmatrix} 5 \\ 10 \end{bmatrix}$	$egin{array}{c} 6 \ 12 \end{array}$	$\begin{array}{c} 7 \\ 14 \end{array}$	$\begin{array}{c} 8 \\ 16 \end{array}$	18
	2	2 4	8	12	16	20	24	28	32	36
9	$\frac{1}{2}$	2.5 $5$	$\frac{5}{10}$	$\begin{array}{c} 7.5 \\ 15 \end{array}$	$\begin{array}{c} 10 \\ 20 \end{array}$	$\begin{vmatrix} 12.5 \\ 25 \end{vmatrix}$	$\begin{array}{c} 15 \\ 30 \end{array}$	$\begin{array}{c} 17.5 \\ 35 \end{array}$	20	$\begin{array}{ c c c }\hline & 22.5 \\ & 45 \end{array}$
10	1	3.5	7	10.5	14	$\begin{vmatrix} 25\\17.5 \end{vmatrix}$	21	24.5	28	31.5
	$\frac{2}{3}$	6	12	18	24	30	36	42	48	54
	3 4	$\begin{array}{c} 9 \\ 12.5 \end{array}$	$\begin{array}{c} 18 \\ 25 \end{array}$	$\begin{array}{c} 27 \\ 37.5 \end{array}$	36 50	$\begin{array}{c c} 45 \\ 62.5 \end{array}$	5 4 7 5	$\begin{array}{c} 63 \\ 87.5 \end{array}$	72 100	$\begin{array}{ c c c } 81 \\ 112.5 \\ \end{array}$
11	1	4.5	9	13.5	18	$\overline{22.5}$	27	31.5	36	40.5
	$\frac{2}{3}$	$\begin{array}{c} 7 \\ 10 \end{array}$	$\begin{array}{c} 14 \\ 20 \end{array}$	$\frac{21}{30}$	28 40	35 50	$\frac{42}{60}$	49 70	56 80	63 90
	4	14	28	42	56	70	84	98	112	126
12	$\frac{1}{2}$	5 8	$\begin{smallmatrix}10\\16\end{smallmatrix}$	15	$\frac{20}{32}$	$\begin{bmatrix} 25 \\ 40 \end{bmatrix}$	30	$\begin{array}{c} 35 \\ 56 \end{array}$	40	$\begin{vmatrix} 45 \\ 72 \end{vmatrix}$
	$-\frac{2}{3}$	$\stackrel{\circ}{=}\stackrel{\circ}{11.5}$		$-rac{24}{34.5}$	$egin{array}{cccc} 32 \ 46 \end{array}$	57.5	$-rac{48}{69}$ $-$	80.5	$\begin{bmatrix} -64 \\ 92 \end{bmatrix}$	$\begin{array}{c c} & 12 \\ \hline & 103.5 \end{array}$
	4	16	23 32	48	64	80	96	112	128	144
13	$\frac{1}{2}$	$-\frac{6}{9}$	12 18	18 27	24 36	30   45	$\begin{array}{c} 36 \\ 54 \end{array}$	$\begin{array}{c} 42 \\ 63 \end{array}$	$\begin{vmatrix} 48 \\ 72 \end{vmatrix}$	54
	$\frac{2}{3}$	13	26	39	52	65	78	91	104	117
	4	18	36	54	72	90	108	126	144	162
14	$\frac{1}{2}$	$\begin{array}{c} 7 \\ 10.5 \end{array}$	$\begin{array}{c} 14 \\ 21 \end{array}$	$\begin{array}{c} 21 \\ 31.5 \end{array}$	28 42	$\begin{array}{c} 35 \\ 52.5 \end{array}$	$\begin{array}{c} 42 \\ 63 \end{array}$	$\begin{array}{c} 49 \\ 73.5 \end{array}$	56 84	63 94.5
	$\frac{2}{3}$	15	30	45	60	75	90	105	120	135
	4 5	$\begin{bmatrix} 21 \\ 28 \end{bmatrix}$	$\begin{array}{c} 42 \\ 56 \end{array}$	$\begin{array}{c} 63 \\ 84 \end{array}$	$\begin{array}{c} 84 \\ 112 \end{array}$	$\begin{array}{c c} 105 \\ 140 \end{array}$	$\begin{array}{c} 126 \\ 168 \end{array}$	$\begin{array}{c} 147 \\ 196 \end{array}$	$\begin{array}{ c c c }\hline 168 \\ 224 \\ \end{array}$	$\begin{array}{ c c c }\hline 189 \\ 252 \\ \end{array}$
15	1	8	16	$\frac{34}{24}$	32	40	48	56	64	72
	$\frac{2}{3}$	12	24	36	48	60	72	84	96	108
	3 4	$\begin{bmatrix} 16.5 \\ 24 \end{bmatrix}$	33 48	$\frac{49.5}{72}$	$\begin{array}{c} 66 \\ 96 \end{array}$	$\begin{array}{c c} 82.5 \\ 120 \end{array}$	$\begin{array}{c} 99 \\ 144 \end{array}$	$\begin{array}{c} 115.5 \\ 168 \end{array}$	$\begin{array}{c} 132 \\ 192 \end{array}$	$\begin{array}{ c c c }\hline 148.5 \\ 216 \end{array}$
	5	32.5	65	97.5	130	162.5	195	227.5	260	292.5
16	$egin{array}{c} 1 \ 2 \end{array}$	$\begin{array}{c} 9 \\ 13.5 \end{array}$	$\begin{array}{c} 18 \\ 27 \end{array}$	$\begin{array}{c} 27 \\ 40.5 \end{array}$	$\begin{array}{c} 36 \\ 54 \end{array}$	$\begin{array}{c c} 45 \\ 67.5 \end{array}$	54 81	$\begin{array}{c} 63 \\ 94.5 \end{array}$	$\begin{array}{c} 72 \\ 108 \end{array}$	$\begin{array}{ c c } 81 \\ 121.5 \end{array}$
	3	19	38	57	$\frac{31}{76}$	$\frac{01.5}{95}$	114	133	152	171
	4	27	$\frac{54}{72}$	81	108	135	162	$\begin{array}{c} 189 \\ 255.5 \end{array}$	216	243 328.5
17	$\begin{bmatrix} 5 \\ 1 \end{bmatrix}$	$\begin{array}{c c} 36.5 \\ \hline 10.5 \end{array}$	$-\frac{73}{21}$	$\begin{array}{c} 109.5 \\ \hline 31.5 \end{array}$	$\begin{bmatrix} 146 \\ 42 \end{bmatrix}$	$egin{array}{c c} 182.5 \ \hline 52.5 \end{array}$	$\frac{219}{63}$	$\begin{array}{c} 255.5 \\ \hline 73.5 \end{array}$	$\begin{array}{ c c c c c }\hline 292 \\ \hline 84 \\ \hline \end{array}$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
1 (	2	15	30	45	60	75	90	105	120	135
	3 4	$\begin{array}{c} 21.5 \\ 30.5 \end{array}$	$-\frac{43}{61}$	$\tfrac{-64.5}{91.5}$	$\begin{bmatrix} 86 \\ 122 \end{bmatrix}$	$oxed{107.5} 152.5$	$\frac{129}{183}$	$\begin{array}{r} 150.5 \\ \hline 213.5 \end{array}$	$\begin{array}{ c c c c }\hline 172 \\ 244 \\ \end{array}$	$\begin{array}{ c c c c }\hline 193.5 \\ \hline 274.5 \end{array}$
	5	40.5	81	121.5	162	$\mid 202.5 \mid$	243	283.5	324	364.5
18	1	12	$-\frac{24}{29}$	36	48	60	72	84	96	108
	$\frac{2}{3}$	$\begin{bmatrix} 16.5 \\ 24 \end{bmatrix}$	33 48	$\frac{49.5}{72}$	66 96	$\begin{array}{c c} 82.5 \\ 120 \end{array}$	$\begin{array}{c} 99 \\ 144 \end{array}$	$\begin{array}{c} 115.5 \\ 168 \end{array}$	$\begin{array}{ c c }\hline 132\\192\\ \end{array}$	$\begin{array}{ c c c c }\hline 148.5 \\ 216 \end{array}$
	4	34	68	102	136	170	204	238	$27\overline{2}$	306

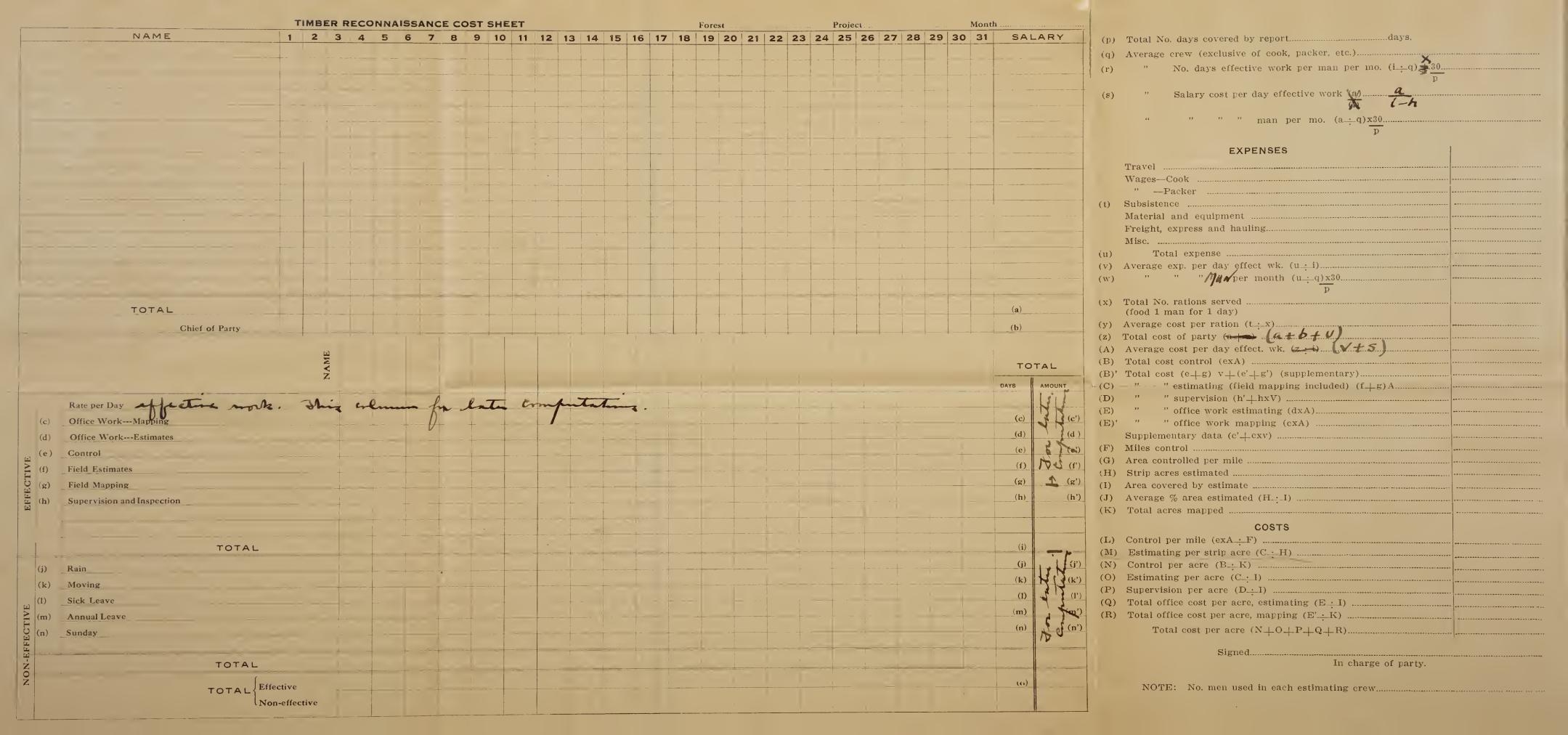
MULTIPLE VOLUME TABLE-LODGE POLE PINE

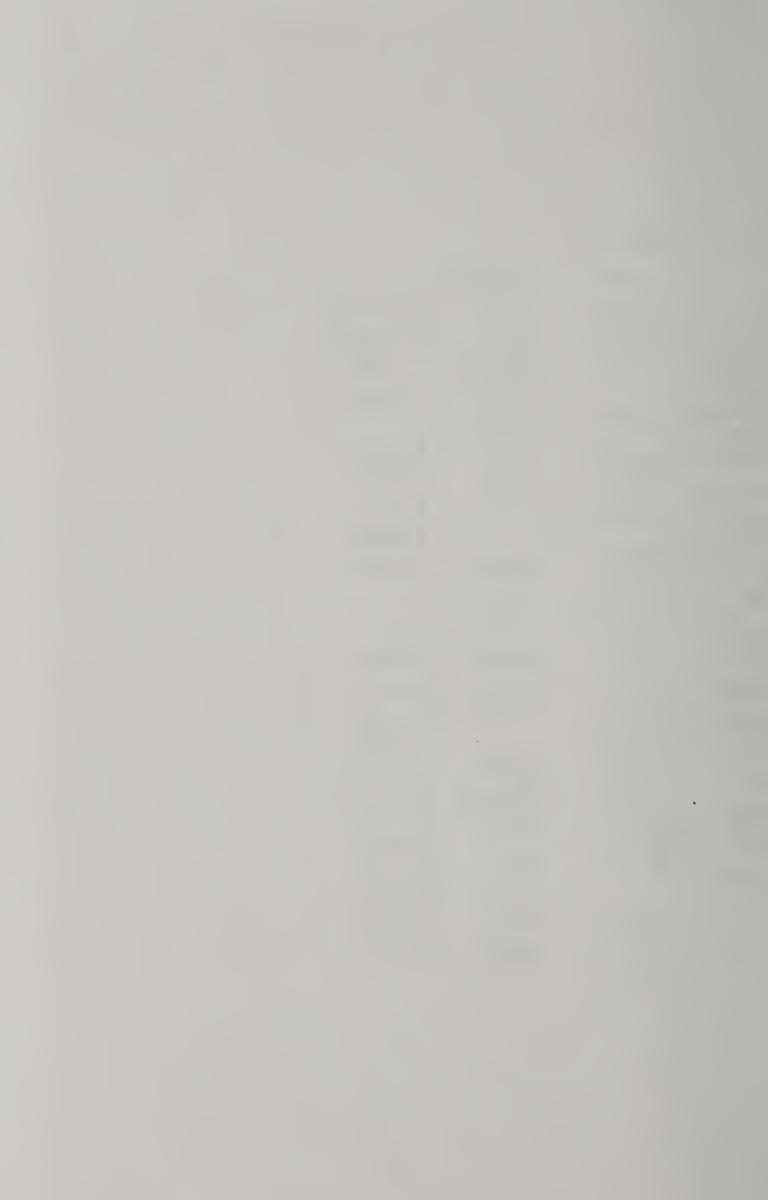
T 1 47

Number of Trees.—Continued.

						 				1
DBH	Logs	1 .	2	9	4	5	6	7	8	9
19	$\begin{bmatrix} 5 \\ 1 \\ 2 \end{bmatrix}$	$ \begin{array}{c c} 44.5 \\ 13.5 \\ 19.5 \end{array} $	89 27 39	$\begin{array}{ c c c }\hline 133.5 \\ 40.5 \\ 58.5 \\ \hline \end{array}$	178 54 78	$ \begin{array}{ c c c c c } 222.5 \\ 67.5 \\ 97.5 \end{array} $	$\begin{vmatrix} 267 \\ 81 \\ 117 \end{vmatrix}$	$\begin{array}{c c} 311.5 \\ 94.5 \\ 136.5 \end{array}$	$\begin{vmatrix} 356 \\ 108 \\ 156 \end{vmatrix}$	$egin{array}{c c} 400.5 \\ 121.5 \\ 175.5 \\ \end{array}$
	3 4 5	$\begin{array}{c} 27 \\ 37.5 \\ 48.5 \end{array}$	$\begin{bmatrix} 54\\75\\97 \end{bmatrix}$	$ \begin{array}{ c c c c } \hline 81 \\ 112.5 \\ 145.5 \end{array} $	$egin{array}{c c} 108 \\ 150 \\ 194 \\ \end{array}$	$ \begin{array}{ c c c } 135 \\ 187.5 \\ 242.5 \end{array} $	$egin{array}{c c} 162 \\ 225 \\ 291 \\ \end{array}$	$\begin{array}{ c c c }\hline 189 \\ 262.5 \\ 339.5 \\ \hline \end{array}$	$\begin{vmatrix} 216 \\ 300 \\ 388 \end{vmatrix}$	$egin{array}{c c} 243 \\ 337.5 \\ 436.5 \\ \end{array}$
20	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	$\begin{array}{c c} 15 \\ 22 \\ 30 \end{array}$	3 0 4 4 6 0	45 66 90	$\begin{bmatrix} 60\\88\\120 \end{bmatrix}$	$egin{array}{c c} 75 \\ 110 \\ 150 \\ \end{array}$	90   132   180	$egin{array}{c c} 105 \\ 154 \\ 210 \\ \end{array}$	$egin{array}{c} 120 \\ 176 \\ 240 \\ \end{array}$	$egin{array}{c c} 135 \\ 198 \\ 270 \\ \hline \end{array}$
21	$\begin{bmatrix} 4 \\ 5 \\ 1 \end{bmatrix}$	$   \begin{array}{c}     41 \\     52.5 \\     17   \end{array} $	$\begin{vmatrix} 82\\105\\34 \end{vmatrix}$	$egin{array}{c c} 123 \\ 157.5 \\ 51 \end{array}$	$\begin{array}{ c c c }\hline 164 \\ 210 \\ 68 \end{array}$	$egin{array}{c c} 205 \ 262.5 \ 85 \end{array}$	$egin{array}{c c} 246 \\ 315 \\ 102 \\ \end{array}$	$egin{array}{c} 287 \\ 367.5 \\ 119 \\ \end{array}$	$\begin{vmatrix} 328 \\ 420 \\ 136 \end{vmatrix}$	$egin{array}{c c} 369 \\ 472.5 \\ 153 \end{array}$
	$\begin{bmatrix} 2\\3\\4 \end{bmatrix}$	$\begin{array}{c} 24.5 \\ 33 \\ 45 \end{array}$	$\begin{bmatrix} 49 \\ 66 \\ 90 \end{bmatrix}$	$\begin{array}{c} 73.5 \\ 99 \\ 135 \end{array}$	$egin{array}{c} 98 \\ 132 \\ 180 \\ \end{array}$	$egin{array}{c c} 122.5 \\ 165 \\ 225 \\ \end{array}$	$egin{array}{c} 147 \\ 198 \\ 270 \\ \end{array}$	$egin{array}{c} 171.5 \\ 231 \\ 315 \\ \end{array}$	$\begin{array}{ c c c }\hline 196 \\ 264 \\ \hline 360 \\ \end{array}$	$\begin{bmatrix} 220.5 \\ 297 \\ 405 \end{bmatrix}$
22	5 3 4	56.5 36.5 48.5	$\begin{bmatrix} 113 \\ 73 \\ 97 \end{bmatrix}$	$ \begin{array}{c c} 169.5 \\ 109.5 \\ 145.5 \end{array} $	$egin{array}{c} 226 \ 146 \ 194 \ \end{array}$	$\begin{array}{c c} 282.5 \\ 182.5 \\ 242.5 \end{array}$	$egin{array}{c} 339 \\ 219 \\ 291 \\ \end{array}$	$   \begin{array}{r}     395.5 \\     255.5 \\     339.5   \end{array} $	$   \begin{array}{r}     452 \\     292 \\     388   \end{array} $	$\begin{bmatrix} 508.5 \\ 328.5 \\ 436.5 \end{bmatrix}$
23	5 3 4	$60.5 \\ 40 \\ 52.5$	$\begin{bmatrix} 121 \\ 80 \\ 105 \end{bmatrix}$	$\begin{array}{c c} 181.5 \\ 120 \\ 157.5 \end{array}$	$   \begin{array}{c c}     242 \\     160 \\     210   \end{array} $	$egin{array}{c c} 302.5 \\ 200 \\ 262.5 \\ \end{array}$	$egin{array}{c} 363 \ 240 \ 315 \ \end{array}$	$\begin{array}{c c} 423.5 \\ 280 \\ 367.5 \end{array}$	484 320 420	$\begin{bmatrix} 544.5 \\ 360 \\ 472.5 \end{bmatrix}$
24	5 3 4 5	$   \begin{array}{r}     65 \\     44 \\     56.5 \\     69   \end{array} $	$   \begin{array}{r}     130 \\     88 \\     113 \\     138   \end{array} $	$ \begin{array}{r} 195 \\ 132 \\ 169.5 \\ 207 \end{array} $	$egin{array}{c} 260 \\ 176 \\ 226 \\ 276 \\ \end{array}$	$egin{array}{c} 325 \ 220 \ 282.5 \ 345 \ \end{array}$	$egin{array}{c} 390 \\ 264 \\ 339 \\ 414 \\ \end{array}$	$\begin{array}{c} 455 \\ 308 \\ 395.5 \\ 483 \end{array}$	$egin{array}{c} 520 \ 352 \ 452 \ 552 \ \end{array}$	$\begin{bmatrix} 585 \\ 396 \\ 508.5 \\ 621 \end{bmatrix}$







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Form 172			TITLE	THOR IN THOSE OF THE PARTY OF T	

